More than 27,000 Copies a Week

Engineering Library

GENERAL LIBRARY

Electrical World

McGraw-Hill Company, Inc. New York, August 21, 1920 Twenty-five Cents a Copy

THE STANDARD PLUG
With PARALLEL Blades
Plugs of this type are now furnished with 200 lines of appliances

NOW CANADA HAS STANDARDIZED

Municipal Electrical Utilities

Report of Regulation and Standards Committee

* * *

be it resolved that this Committee recommend and adopt the use of receptacles, plugs and plug caps as follows:

1. Receptacles shall have parallel contacts or contacts suitable for both parallel and tandem caps.
2. Plug bases shall have parallel contacts or contacts suitable for both parallel and tandem caps.
3. Caps shall have parallel contacts.

* * *

The report met with the hearty approval of the delegates and was unanimously carried.

NOW CANADA IS SPARTANIZED

THE BRYANT ELECTRIC COMPANY

BRYANT
SUPERIOR WIRING DEVICES

BRIDGEPORT, CONNECTICUT.

for Precision in Test Work

Weston
Model 329

Portable Polyphase Wattmeters

These Instruments are striking examples of successful instrument construction. They embody many mechanical and electrical refinements which have resulted in the production of the peerless wattmeter. Being shielded, they may be used in the proximity of stray fields.

Having an accuracy of ¼ of 1 per cent of full scale value under normal working conditions, they are excellent working standards as well as test Instruments. They have double current and potential ranges that may be quickly changed. The power consumption is very small.

Their phase angles being exceedingly small, these Instruments may be used on low power factors without appreciable error in the readings.

Model 329
Portable Polyphase Wattmeter

The current coils have 150 per cent overload capacity. The overload capacity of the Potential circuit is ample and varies with the range.

Special Instruments are available for use on very low factors.

Write for Bulletin 2004

Weston Electrical Instrument Co.
13 Weston Ave., Newark, N. J.

New York	Buffalo
Chicago	Minneapolis
Philadelphia	New Orleans
Boston	Jacksonville
Cleveland	Seattle
Detroit	Toronto
St. Louis	Montreal
San Francisco	Halifax
Denver	Winnipeg
Cincinnati	Vancouver
Pittsburgh	Calgary, Alta.
Richmond	

And in Principal Cities Throughout the World

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician
Published by McGraw-Hill Company, Inc.

W. H. ONKEN, Jr., Editor D. H. BRAYMER, Managing Editor
S. B. WILLIAMS, Assistant Managing Editor A. M. PERRY, Engineering Editor J. C. MARTIN, Western Editor ROBERT SIBLEY, Pacific Coast Editor H. S. KNOWLTON, New England Editor
Associate Editors: P. S. BIEGLER, C. T. BALDWIN, S. N. CLARKSON,
R. H. BACON, T. P. KINDIG, R. M. DAVIS, E. H. HUBERT, F. C. WELLS

Volume 76 New York, Saturday, August 21, 1920 *Number* 8

For Better Public Relations

REALIZING that whatever helps the industry will in a measure benefit every company forming part of it, the Western Electric Company has published a series of advertisements in the interest of the electrical industry, particularly the public utilities. We cannot commend this spirit too highly, and what one manufacturer and jobber has done in a large way ought to be done by every individual connected with the industry in proportion to his interest and means. The electric utilities have been singled out because after all is said and done their prosperity is the index for prosperity all along the line. Moreover, only as the industry attains popular understanding and esteem will permanent prosperity ensue. There is no doubt that the publicity will go a long way toward building up good will for the industry, but the task is too great for any one company. It merits and demands the hearty co-operation of the entire industry.

Engineering Scrutiny of Accounts

UNLESS central-station accounting reveals significant information, its right to occupy ledger space should be sharply questioned. For instance, it cost a representative company 7.3 mills for fuel recently for every kilowatt-hour generated in its steam plant. The accounts showed a fuel cost of 6.3 mills, and upon inquiry it was found that the coal expense and all other operating costs at the plant are regularly determined on the basis of the total generated and purchased energy. Examples of this kind reveal the opportunity which exists for accountants and engineers to get together in the interest of standardizing data of real technical significance—data which will mean something because of their correct engineering foundation and not convey false impressions of operating efficiency when laid before the management month after month for use in checking plant performance.

Traction Companies as Customers

ELECTRIC railways are turning more and more to the central station for power supply as the cost of fuel and the difficulty of obtaining it increases. This class of business has the advantage of large annual volume in many cases, combined with excellent power-factor regulative possibilities through the use of rotary converters or synchronous motor-generator sets in transforming the transmitted energy for traction needs. While each case and each contract require separate investigation, the economics of the situation broadly favor the purchase of power derived from concentrated and perhaps from interconnected generating units of high efficiency, with the shutting down of relatively small direct-current steam plants which are today unequal to the demands of the best engineering operation. In Massachusetts, for instance, there have been realized within the past decade extraordinary savings in fuel consumption resulting from the supply to electric railways, from one end to the other almost, of energy from interconnected hydro-electric and steam stations operated by electric service companies. The good work still goes forward, and in the near future it will be strange if other groups of scattered plants now handicapped by coal shortages and high costs do not swell the total of satisfied Bay State central-station customers. Interconnection minimizes the bad effects of the fluctuating railway load, and a simplified and more reliable fuel supply is a telling argument in times like the present.

Developing World Trade

IT OUGHT to be apparent to every thinking American that the country's foreign trade is of direct significance to him personally. Every man, whether he makes his home in the agricultural districts of the Far West or in such industrial centers as Pittsburgh or New York, has a selfish interest in cargoes carried in American ships to all corners of the globe. The South can only prosper when there is an export demand for all the cotton it can produce, and prosperity in the Northwest is linked in large measure with the export of lumber. As no city lives unto itself or is sufficient unto itself, neither is any state or country, and to give a reason why sound thinking and co-operative action should necessarily be limited exclusively to one's country and not shared with the rest of the world is at times baffling. That the condition exists none can deny, and thus it will continue to exist until American manufacturers throw over their policy of exclusion and see in the markets of the world legitimate outlets for their products. The country is burdened with enormous war debts which must be liquidated through taxation, and if these debts are not to overwhelm us production must greatly exceed consumption. But we cannot dispose of the excess unless we develop world trade, and this applies to every industry that can turn out goods of a character or at a price that will be in large demand beyond our borders.

Home Rule in Denver

THE destruction of life and property which attended the strike of the Denver Tramway Company employees may be attributed in a measure to the peculiar regulatory system existing in Colorado. In a test case before the Colorado Supreme Court brought by the municipal authorities at Denver it was held that that city and other home-rule cities in Colorado could regulate their public utilities to the exclusion of the state authorities. However, when local regulation became effective in Denver trouble ensued. Lower fares were fixed by ordinance, necessitating a lower wage scale, and naturally a strike resulted. Cars stopped

running, business was paralyzed, and newspapers which had theretofore proclaimed home-rule regulation as a victory for the people reversed themselves and urged the recall of the Mayor. Conditions became normal again in Denver only with the restoration of the higher wage scale and the 6-cent fare. The causes of the recent disturbance were not very different from those which precipitated the previous strike, and they call attention anew to the fallacies of home rule and municipal regulation. The moral is very plain, and the prayer of every public utility manager should be, "From the machinations of local politicians and municipalities good Lord deliver us!"

Danger in Valuations at Present-Day Figures

ATTEMPTS for rate-making purposes to value at present-day prices physical properties wholly or almost wholly constructed during the low-price periods before the war are likely to be the means of expending valuable energy that will not accomplish results and may produce bad feeling against utilities. The remedy for increased operating costs must to some extent be increased economies, though under existing conditions the chief remedy must be increased rates. Increased construction costs affect not only additions but also replacements of existing property that must be made through depreciation accounts.

Increases in rates due to increased operating costs bear no relation to investment and must therefore be justified on operating facts alone. Fixed charges which are determined by investment in the business can be taken care of in two ways, one by arbitrarily increasing valuation figures to a point where certain fixed percentages will provide the necessary returns, the other by permitting investments to stand at whatever figures the records of construction costs justify and increasing fixed-charge percentages to meet conditions. Any rule must work both ways, and it must be assumed that if properties are valued at costs during high-price periods they must be similarly valued during low-cost periods. The second method has the advantage of justification on the basis of figures that are prevalent in the market and which cannot be a matter of opinion.

The weakness that exists in many cases, however, is the inability of utilities to prove what their properties have actually cost because construction records have been so carelessly kept that obvious errors destroy confidence in them. The remedy for such a condition is reform in the methods of keeping construction records. The sooner utilities face the fact that returns calculated on investment and varied to meet the conditions existing at any particular time are the surest way to obtain the necessary results, the easier the solution will be.

It will be argued that public opinion cannot be brought to realize the necessity for changes with sufficient promptness to meet emergencies. If the game is played in a clean, aboveboard manner that will secure public confidence, there is nothing to fear. It is arguing for methods that arouse public suspicion that makes the task difficult, and the valuation question is particularly susceptible to handling in such a manner. Concrete facts about construction costs are a much better foundation to build on than expert opinions. There is plenty of room for argumentative ability in the field of intangible values, if argument is sought.

Brush Reliability

BRUSHES constitute one of the most important details of motor equipment affecting the reliability of operation, and hence must be selected with considerable care if the highest continuity of service is expected. That no one appreciates this more than the manufacturer is shown by John S. Dean in a very complete discussion of carbon-brush testing in this issue. In order to give intelligent consideration to the selection of brushes, the user should be conversant with their essential characteristics and should have a thorough understanding of the best methods of determining their strength, hardness, density, specific resistance, contact drop, coefficient of friction and thermal conductivity. Information on these subjects is given in the article mentioned. The brush user is dependent to a great extent on the manufacturer for uniformity of product, and that this faith is not misplaced is shown by the elaborateness of tests which are used by one company to check the various brush properties.

Revision of Bureau of Standards Safety Code

CO-OPERATION of the National Electric Light Association with the Bureau of Standards in the development of the National Electrical Safety Code has been one of the outstanding instances of the co-operation of an industry with a governmental body preparing requirements largely restrictive of the practices of that industry itself. As might be expected, the requirements of the safety code, even after some years of this co-operation, are by no means satisfactory in all respects to the association members. The period of co-operation has, however, given both to the bureau and to the association membership a mutual appreciation of the difficulties involved in the preparation of rules which shall be reasonable and well balanced among themselves so that undue stress shall not be laid on some one feature to the comparative neglect of other features of perhaps greater importance. It is largely because of such difficulties that certain state commissions in their rules have incorporated changes in one or more rules of the safety code, which was otherwise quite closely adhered to.

Tendencies to undue severity in certain rules were early noted as arising out of the pressure of other interests to secure safety code requirements bearing with particular severity on power companies where the service of these other interests was even slightly affected by the power company's construction. With the amount of hazard often difficult to evaluate or to separate from the idea of service which these other interests have largely in mind, the bureau, in its tentative proposals in previous code editions, in many cases included requirements which were without doubt unwarrantably severe on the power companies, tending unduly to curtail power service extension.

Careful surveys and collection of records brought about proper modification in many of these proposed requirements and in other cases have shown the necessity and paved the way for further and more extended studies, as in the case of transverse strength requirements for wooden poles. Other interests have sometimes actively opposed modifications but have usually acquiesced in decisions arrived at by the bureau backed by proper records of experience and test data.

This year the formation by the N. E. L. A. of an engineering department has made possible a more continuous and effective conduct of studies of this kind. It appears to be the anticipation of both the bureau and the N. E. L. A. that not only will the present and more outstanding differences of opinion yield to the results of the various studies to be undertaken during the next few years, but that these outstanding rules can be clearly recognized in the forthcoming edition of the safety code as proposed standards of practice less adequately supported by judgment and experience and less suitable to mandatory adoption and application than other rules to which no such serious objections are taken.

Assuring Reliable Mine Signal Systems

ON GENERAL principles all electrical installations in mines involve special difficulties, none more so than the all-important signaling system for the hoists which in deep-shaft mining are so vital. Our readers will therefore be interested in the valuable discussion on the subject by R. H. Bacon in our columns this week. While dealing directly with the situation in mines, the principles are the same that are requisite to reliability in any important signaling equipment. The underlying principle followed is that any signal must be repeated back to the sender so that a slip may be detected and corrected. The particular case considered is that laid out for a shaft nearly a mile deep where ordinarily a dispatcher sends all signals to the hoisting engineer but provision had to be made for operation direct from under ground as well. The signals used include bells, buzzers and lamps, the last named for checking-back purposes and in groups for reserve against a burn-out. At every stage the connections are made so as automatically to check back the signal, quite independently of a complete telephone connection which is kept entirely clear of the signal system, not even being in the same conduit.

In some mines are found two distinct signal systems, one specifically directing the hoisting and a second of wider distribution for signaling station tenders and calling the mine telephones. The source of energy varies, but Mr. Bacon prefers the regular alternating-current lighting current. The amount of available power required is not inconsiderable since powerful solenoid single-stroke bells are desirable, some of them carrying gongs up to 18 in. (45 cm.) diameter, and the buzzers are of a very solid construction. The wiring system is naturally very far from common bell-circuit practice. Conduit circuits wired with rubber-covered wire up to No. 8 are in frequent use, as are also leaded cables of similar capacity.

In either case oil switches are widely used. It is a case of signaling that falls almost into the power distribution class. Mr. Bacon gives the cost of equipping one 3,000-ft. (900-m.) shaft as very little short of $2,000—an amount quite justified by the added security given. Mine signaling, in fact, is a task somewhat resembling railway signaling, with the same necessity of certainty of action and the same requirement of giving no chance for failure of a kind not immediately apparent. It is instructive to realize how apparently simple wiring tasks may develop in these days into real engineering problems that require no little skill and forethought.

Preaching the Gospel of Production

FOR many ages the gospel of work has been preached with much simulated zeal and few real proselytes. The primeval curse has blocked the path of ready acceptance, and to the vast majority of mankind toil has been but a hateful necessity. Men have worked to live, not lived to work. Save in their spasms of ideal morality, not their stretches of labor but their intervals of relaxation have really made life sweet. Play, repose, wanderlust, *dolce far niente*, the open road, the loafing invitation to the soul, the subarboreal book of verses with the classic, if now forbidden, jug of wine—let us confess it, these things, and not the inexorable whistle of the factory or the cock's shrill clarion commandeering for the plow, have ever been those to which the unregenerate heart has thrilled. The exceptions have arisen where work and play are synonymous terms; that is, where men have been gardeners or sailors, artists or preachers, inventors or engineers, by the compulsion of nature and not of fate.

The gospel of work has erred in putting its emphasis in the wrong place. Not in work but in production lies the real happiness of humanity. Not in hoeing the grain but in seeing it ripen, not in laying the bricks but in watching the house take shape, not in filling the molds with molten metal but in contemplating the finished machine, dwells contentment with laborious days. Therefore governments and industrial exhorters and public utilities in their efforts to get larger results from labor are right in putting the stress not on the work that must be performed but on the production in which it culminates. No spasmodic urge back to the paleolithic age can root out the acquisitive instincts of our modern civilization. Every man has wants he yearns to fill—with the least possible exertion, assuredly, but with as much exertion as must be.

Only the occasional man, of course, can aid directly in producing for himself the objects he wants, but all men can aid in producing something that others want, and by the easy process of exchange they can thus supply their own desires. A man produces potatoes and changes them into an autocar; another makes, conjointly with his fellows, an autocar and receives in exchange a suit of clothes; a third tailors a suit and fills his family bin with potatoes. Thus the never-ending cycles with their intricate convolutions go around.

The gospel of production does not connote a reciprocal gospel of contentment with little. On the contrary, the larger an honest man's imperative wants the more willing he becomes to contribute to the general fund from which they must be filled. The more each produces in fair competition the greater the product to which each is entitled. The new gospel should strive to make certain that title is followed by acquirement. This has not always been the fact. Nor has full advantage of Nature's forces ever been taken to reduce human effort. The true gospel of production means added incentive, lessened fatigue. Work for work's sake is an unattractive doctrine. Work for production's sake, with electricity and water power and steam to bear the brunt, is the doctrine of the future, when mankind, with vastly increased wants, will perhaps satisfy them more easily than our remote ancestors satisfied the mere cravings of their stomachs. This is where the visions of the poet and the man of affairs approach each other—where the dreamer and the engineer shake hands.

A. G. Wishon

Pioneer builder of water powers in the High Sierras, whose work in furnishing electric service for irrigation is inseparably connected with the development of the San Joaquin Valley

LONG before the transmission of electrical energy even for very moderate distances was considered feasible, A. G. Wishon had made surveys and construction estimates for water powers in the High Sierras that have since proved to be among the most noted hydro-electric developments in this country and one of the sources of power for the highest transmission voltage. In those early days Mr. Wishon visualized the part that electric service might play in developing the desert lands of the San Joaquin Valley. The thousands of acres of veritable gardens that have since been created are the product in large measure of the persistence and undaunted courage with which he has sought and successfully secured capital for power developments. With the assistance of John Hays Hammond in 1898 he founded the Mount Whitney Power Company and built two of the stations that are now a part of the Southern California Edison Company's system and tied in with the 150,000-volt transmission line leading into Los Angeles. In 1902, however, before the completion of the second plant, he became identified with W. G. Kerckhoff and A. C. Balch, capitalists of Los Angeles, in the purchase of railway, water and power properties in the city of Fresno. This led up to the formation of the San Joaquin Light & Power Corporation, the management of which he still retains. From a single station of 1,450 kw. Mr. Wishon has built up a system of thirteen hydro-electric stations, including the new Kerckhoff station started last Sunday, which aggregate 62,675 kw., supplemented by four steam stations of 26,875 kw. These stations feed a transmission network covering 34,944 square miles of the fertile San Joaquin Valley. This network irrigates over 250,000 acres of farmland.

That the early vision of Mr. Wishon in this development work has already materialized is evident from the fact that for 1903 the company's revenue was $126,315.13. For 1920 it is estimated at $4,500,000, representing an annual increase of nearly 100 per cent since 1915. And still the power needs of the San Joaquin Valley, noted for its extensive vineyards, are only partially provided for, and further agricultural development is dependent upon and waiting for additional water power, while additional water power in its turn waits on additional capital. The recognition of this fact by the public and its readiness to assist in furnishing the needed capital are a well-deserved tribute to the small group of men, among whom Mr. Wishon has always been a leader, who builded better than they knew in the days of their adversity, less than twenty-five years ago, when capital fought shy of a section that was then little more than a barren desert. Mr. Wishon was born at Coppeges Mill, Mo., Nov. 6, 1858. Further details of his career appear on page 402.

Carbon-Brush Testing

To Insure Uniformity of Product, a Consideration of Great Importance to Its User as Well as to the Manufacturer, Strength, Hardness, Accuracy of Dimensions and Specific Resistance Are Important Characteristics

By JOHN S. DEAN
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ONE of the most important factors associated with carbon brushes, and one in which both the consumer and the manufacturer are vitally concerned, is the uniformity of the product. This is of the utmost importance from the operator's standpoint. After deciding to use a certain grade of carbon which best meets his operating conditions as determined by a long series of service tests on sample carbons, he depends entirely upon the manufacturer to continue to supply this grade of carbon with similar characteristics on all future shipments. If for any reason this is not done and some of the carbons in service do not measure up to the samples furnished, there is a strong inclination on the part of the operator to discontinue using this brush and look to another manufacturer. Some knowledge of brush composition, together with their test characteristics, is therefore essential to the user if an intelligent selection of brushes is to be made.

Depending upon their composition, brushes may be divided into seven classes, as follows:

1. *Carbon Graphite.*—Known as the ordinary carbon brush and consisting of amorphous carbon in the form of coke, with a small percentage of graphite and binder.

2. *Graphite Carbon.*—With either a mixture of a large percentage of artificial graphite, some coke and binder, or with a mixture of a large percentage of natural graphite, some coke and binder.

3. *Electro-graphitic.*—Consisting of (1) and (2) graphitized by special electrical treatment.

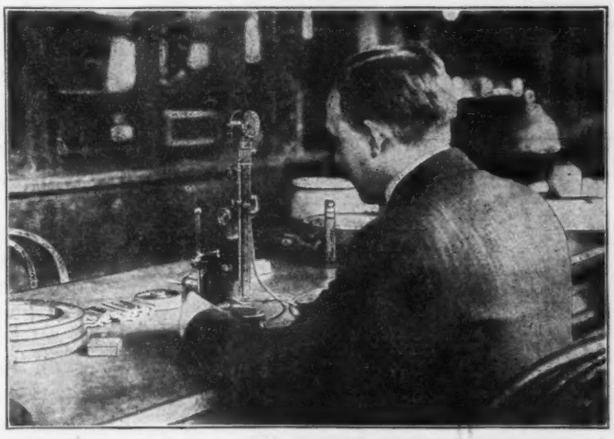
4. *Graphite.*—Made of natural graphite and binder.

5. *Impregnated.*—Consisting of carbon graphite brush treated with a lubricating material.

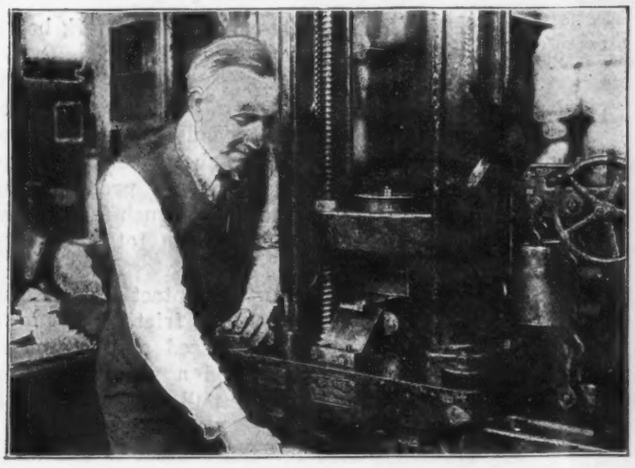
6. *Metal Graphite.*—Made of a mixture of graphite, powdered metal and binder.

7. *Compound Brush.*—Consisting of alternate layers of carbon and metal.

The two most common methods of manufacturing carbon brushes are termed the extruded or squirted method and the molded or machined method. In the former of these the material in the form of pulp is forced through a metal die under pressure and then cut off to the desired length and baked at a high temperature to carbonize the bond and permanently set the material. This method is used in making the cheaper grade of carbons, which do not have the strength to resist the breaking and chipping in service. The "molded or machined" method consists in molding the material into blocks under heavy pressure and then baking it. Carbons are cut from these blocks and machined to exact size. The manufacturer takes all precautions to insure a uniform product in the various grades of carbons that are manufactured.



To accomplish this a careful inspection and test must be made of the raw material as it is received and during the processes of manufacture as well as of the finished carbons. These



CONTINUED UNIFORMITY OF BRUSHES CAN BE ASSURED ONLY BY CAREFUL TESTING OF SAMPLES

The scleroscope shown in the upper picture is used for testing the hardness, and the brushes are graded accordingly. Strength tests are made with the machine shown in the lower picture on the left. Thickness is the most important dimension of a brush, and care must be taken to see that this dimension does not exceed the allowable tolerances.

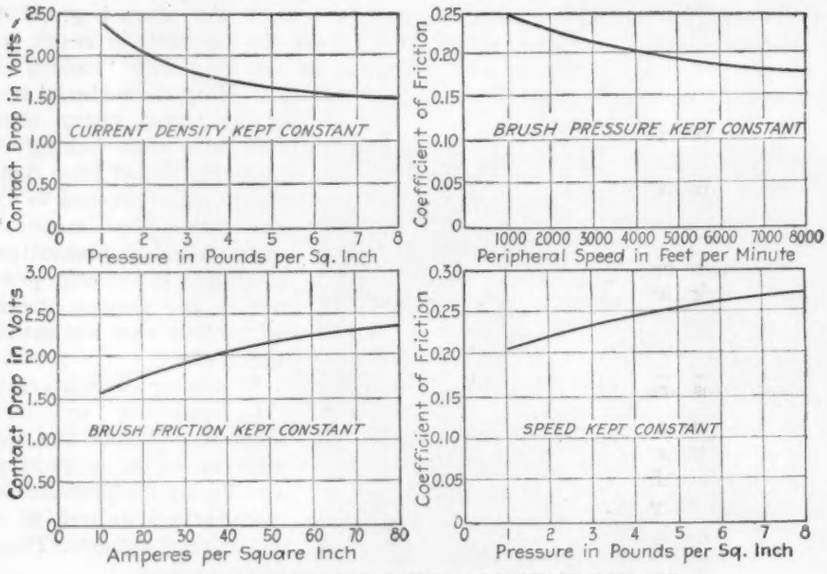
In the right-hand picture is shown the method used for the purpose of gaging dimensions.

tests are made on samples taken from approximately 10 per cent of the material and finished carbon.

Specific Resistance.—The specific resistance of a brush is the electrical resistance of an inch cube of the material measured between opposite surfaces, expressed in ohms. For measuring this a testing outfit, consisting of the well-known Wheatstone bridge, with the carbon test piece as one leg and the standard resistance as a second leg, and the adjustable divisions of a one-meter resistance wire as the other two legs in the bridge, is used. The test specimen consists of a ½-in. (1.27-cm.) square section of carbon 2½ in. (6.35 cm.) long, having, therefore, a resistance ten times that of an inch cube.

The specific resistance depends on the composition of the brush and varies from 0.0025 ohm to 0.0001 ohm. The specific resistance of a good grade of electro-graphite brush suitable for railway work should measure about 0.0015 ohm.

Contact Drop.—The electrical contact drop of a brush is the sum of the difference in voltage between the positive brush and commutator surface and between the commutator surface and the negative brush. This contact drop is determined by means of special apparatus consisting of a motor-driven flat copper disk and two brushes in contact with the vertical face of the rim. The current passes through the positive brush to the wheel and out at the negative brush. The voltmeter leads are connected one to each brush as near to the brush face as possible. The voltmeter then reads the drop between the brushes.


Contact Drop in Volts
CURRENT DENSITY KEPT CONSTANT
Pressure in Pounds per Sq. Inch
Coefficient of Friction
BRUSH PRESSURE KEPT CONSTANT
Peripheral Speed in Feet per Minute
Contact Drop in Volts
BRUSH FRICTION KEPT CONSTANT
Amperes per Square Inch
Coefficient of Friction
SPEED KEPT CONSTANT
Pressure in Pounds per Sq. Inch

BRUSH CHARACTERISTICS SUCH AS CONTACT DROP ARE DEPENDENT ON MANY VARIABLES

These curves show the results of tests to determine the relation between contact drop, brush pressure, current density, principal speed and friction

The size of the test piece will vary in accordance with the general design of the holder. The use of a piece of brush with a cross-sectional area of 1 sq.in. (6.45 sq.cm.) will simplify the computation to a considerable extent. Special brushes are required for this test, each of which must have two pigtails, for connection to the ammeter and the voltmeter circuit respectively.

The test specimens are inserted in the holders and the apparatus is operated for some time with the current flowing until a characteristic surface has been formed. The brush pressure, current density and peripheral speeds are then adjusted and readings are taken giving the contact drop from brush to brush at the current density, brush pressure and peripheral speeds used.

The value obtained for the contact drop is determined largely by the material in the brush, the pressure between brush and commutator, the current density and the condition of the surface of the commutator and the brush face, and will vary from 1.25 volts to 2.75 volts.

What Is Brush Current-Carrying Capacity?

The current-carrying capacity of a brush is the density of the current that the brush can carry continuously without serious heating, expressed in amperes per square inch of contact surface. Not only the actual load current of the machine is considered in this connection but also the short-circuit current that the brush must carry.

There is no laboratory method of testing a brush for this characteristic. It is dependent on so many factors that a test other than operating under service conditions would have but little meaning. Fundamentally the carrying capacity of a brush is limited by the temperature reached at the contact face, and all conditions having influence on this temperature affect the carrying capacity in a given instance. It is the practice of carbon manufacturers to rate brushes in this respect in accordance with what they have observed the brush will carry in service without distress. Ratings given are for continuous service, so that intermittent service such as is encountered on railway motors will permit the use of higher current density than the standard rating of the brush would indicate.

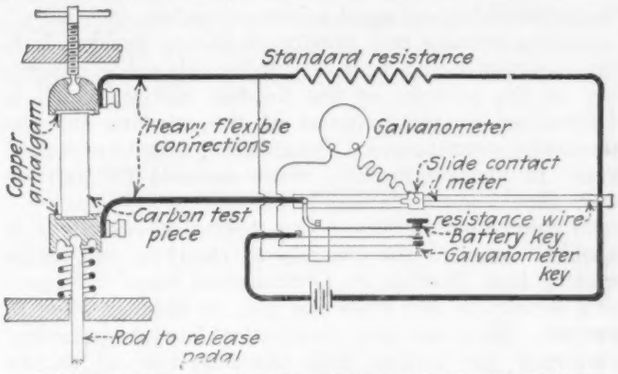
The current-carrying capacity depends upon the composition of the brush, specific resistance, contact drop, coefficient of friction, thermal conductivity of the brush itself and the radiation factor of the machine in operation. It will vary from 35 amp. to 70 amp. per square inch, the value for a good grade of electro-graphite brush suitable for railway work being about 50 amp.

Coefficient of Friction.—The coefficient of friction of a brush is the ratio of the force preventing rotation (the tangential pull exerted by the commutator upon which the brushes bear), due to friction of the brushes, to the force pressing the brushes (radial pressure applied at the brush face) down upon the commutators; that is, to the total pressure on the brushes.

The machine used for measuring contact drop is also used in measuring the coefficient of friction. In this machine the brush holders are placed on a counterbalanced arm to which is attached a vertically hung spring balance which registers the pull due to the brush friction.

The test specimen used for the contact drop test is utilized for this also, preferably with 1 sq.in. (6.45 sq.cm.) across sectional area. In this test pigtails are not necessary. In making the test brushes are placed in the holder and the motor is operated until the brushes are well seated. It is advantageous to run this test immediately after the contact drop test, as it is then

unnecessary to remove the brushes from the holder. With the above apparatus it is possible to hold the current density and brush pressure constant while data for a curve between coefficient of friction and peripheral speed are made, or by holding the speed constant



SPECIFIC RESISTANCE IS MEASURED BY THE WHEATSTONE BRIDGE METHOD

data for a friction pressure curve may be obtained. From the readings on the spring balance the dragging force is calculated by the law of moments as follows:

$$F = R/r \times P,$$

where

F = dragging force.

R = radius at which dragging pressure on vertical spring balance is measured.

r = radius at which brush makes contact on revolving disk.

P = pull on vertical spring balance.

By using this value of F and the brush pressure on horizontal spring balance F_1 the coefficient of friction is readily calculated by the following formula:

$$\text{Coefficient of friction} = \frac{F = \text{dragging force}}{F_1 = \text{total brush pressure}}$$

The coefficient of friction is subject to a wide variation due to the peripheral speed of the commutator, brush pressure and composition of the brush, as well as the process of manufacture. This value will vary

TABLE I—PHYSICAL CHARACTERISTIC OF BRUSHES

Characteristics..	Electrical.....	Specific resistance Contact drop Current-carrying capacity
	Mechanical....	Cofficient of friction Hardness Toughness or strength Abrasiveness Density Thermal conductivity Dimensions

from a little above zero to 0.75. On account of this wide variation brush engineers have, for convenience, classified brushes as "high," "medium" and "low," depending on the coefficient of friction. Accompanying graphs show the variation of the coefficient of friction due to a change in peripheral speed and the effect of a change in brush pressure on the coefficient of friction. The coefficient of friction of a good grade of electro-graphite brush suitable for railway work should measure about 0.22.

Hardness.—The hardness of a brush relates to the compactness of the mass of the brush as a whole and depends on the cohesion of the particles on its surface as determined by its capacity to scratch another or to be itself scratched. It is expressed by a figure which shows a relative measure of ability of its surface to resist penetration. There is no absolute unit of hardness, and the readings obtained on the scleroscope are relative figures, which are useful only for the purpose of comparison, but which are very essential as a check on the uniformity of the product. The hardness figures as determined are usually an indication of the strength of the brush.

Results obtained vary from 10 to 75 for brushes, depending upon the material and methods of manufacture. Brushes are graded according to their scleroscope readings as follows:

Scleroscope Readings	Degrees of Hardness
0-15	Very soft
16-30	Soft
31-45	Medium
46-60	Hard
61-75	Very hard

A good grade of electro-graphitic brush suitable for railway work should have a hardness figure of about 60.

TOUGHNESS IS ESSENTIAL

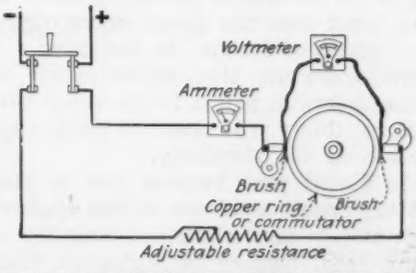
Toughness.—A brush is tough or strong when it will endure the application of force without breaking or yielding, possessing the quality of flexibility without brittleness. The strength of a brush determines its ability to withstand chattering in the carbon box without chipping or breaking. It is expressed in pounds per square inch.

A special testing machine is used for making this test and test carbons are cut ½ in. (1.27 cm.) square and 6 in. (15.24 cm.) long. The test piece is placed on two knife-edge supports, 4 in (10 cm.) apart, and the load is gradually applied at the center until the piece breaks. The strength is computed in pounds per square inch by means of the following formula:

$$S = WcL/4I,$$

where S = strength in pounds per square inch, W = load in pounds, c = one-half the thickness of the test piece, L = distance between supports, I = moment of inertia, 1/192 in this case.

Typical test results vary over a considerable range from 1,000 lb. to 8,000 lb. (70 kg. to 560 kg. per sq.cm.) depending upon the material entering into the mixture as well as the method of manufacture. The strength of a good grade of electro-graphite brush suitable for



CONTACT DROP IS DETERMINED BY READING THE VOLTAGE DROP BETWEEN THE TWO BRUSHES

railway work should be about 5,500 lb. per square inch (385 kg. per sq.cm.).

Abrasiveness.—Resistance to abrasion or scouring action of the carbon brush is the ability to withstand the wear due to friction. This term should not be confused with hardness. Hardness relates to compactness

of the mass as a whole, while abrasiveness relates to the cutting action given a brush due to more or less gritty particles in the brush mixture.

There are no reliable tests for abrasiveness. Efforts have been made to develop an apparatus to test this characteristic, but these have failed to produce results that check with actual experience with the different grades of carbons under service conditions. This is attributed to the influence of the commutating currents on disintegration at the brush face, which cannot be reproduced on the testing machine. Brushes which showed decided abrasive characteristics in operation will sometimes glaze over on the test machine and run for a long period of time without wear.

Density.—The density of a brush is the quality or state of having the constituent parts massed or crowded together. The real density of a brush is the weight of the carbon exclusive of pores compared to the weight of an equal volume of water, while the apparent density is the weight of the carbon with the pores compared to the weight of an equal volume of water.

The equipment necessary for determining density is a micrometer reading to 0.001 mm. and of a size adaptable to the test specimen and an analytical balance weighing to 0.0001 gram.

The test specimen may be of any uniform size, although 2½ in. x ½ in. x ½ in. (6.35 cm. x 1.27 cm. x 1.27 cm.) is a most convenient size.

The test specimen is carefully measured for length, width and thickness and the volume is computed in cubic centimeters. This piece is then weighed and the apparent density computed by comparing it to the weight of an equal volume of water. The real density requires a more elaborate test as it is necessary to take into account the porosity of the material. To do this a sample of known volume is saturated with a liquid of known density and the weight of the saturated piece is determined, the apparent density of the sample having been previously calculated. It is then possible to make a correction for the liquid used to saturate the sample and to determine the real density of the test carbon exclusive of the pores by comparing this correct weight to the weight of an equal volume of water.

As the average real density of carbon brushes is 2, the apparent density will vary below this value, depending on the porosity of the finished carbon, which is determined by the material of the mixture and the process of manufacture. The apparent density of a good grade of electro-graphitic brush suitable for railway work should be approximately 1.5.

Thermal Conductivity.—The thermal conductivity of a carbon brush is the property of receiving and transmitting heat through its homogeneous mass from particle to particle and from one body to another when in contact. There has been no practical laboratory method developed for testing this characteristic of carbon brushes. This property depends upon the material in the brush as well as the method of manufacture. There is no practical unit of measurement of this characteristic. Graphite has a higher thermal conductivity than most forms of carbon. A good grade of electro-graphitic brush suitable for railway work should have the maximum thermal conductivity allowable.

The above allowances are in accordance with the specification as adopted by the Power Club.

In the preparation of this article the writer has been indebted to H. A. Humiston of the National Carbon Company and W. C. Kalb of the Corliss Carbon Company for very valuable suggestions and assistance supplied by them.

Designing Mine Signal Systems

Operating Factors That Affect Selection of Circuit Layout in Deep-Shaft, Metal Mines—Ruggedness of Equipment Shown in Recent Work of This Class—Costs of Modern System for a 3,000-Ft. Shaft

By R. H. BACON
Formerly Assistant Electrical Engineer Copper Range Company

FEW classes of service are more severe on electrical equipment from an operating standpoint than mining, and the signal system, vital as it is to the continuous operation, safety and speed of hoisting, must meet the severe operating conditions by proper features of design. In designing a system it would seem, therefore, that consideration should be given to the following points in the order given: (1) Safety, (2) reliability, (3) speed of operation, (4) low maintenance cost, (5) simplicity.

Safety is placed first because this is one of the weightiest arguments in favor of the electric system. It is comparatively easy while designing the system to arrange the bells, buzzers or lights so that at any place in the shaft, shaft house or engine house it will be possible to tell what is going on and for the sender of a signal to know that the signal was received correctly. If this is not taken care of in the design, one of the important features is lost. Nothing gives a greater feeling of confidence and security than to hear a signal repeated back.

Reliability is self-explanatory. Without it the system loses the confidence of the men and is a serious handicap to production if time is lost in changing over to the rope-pull bell. Reliability can be attained only through the careful laying out of all details of the equipment, as will be pointed out.

Speed of operation is essential in a busy shaft, but safety or reliability should not be sacrificed to obtain it. As a rule signals can be sent on any electric system as fast as they can be interpreted.

Low maintenance cost is not necessarily an offshoot of reliability. Sometimes reliability is attained at the expense of high maintenance costs due to continuous inspection. To cut down the cost of maintenance a system should be so designed that reliability will be attained through rugged equipment and not by constantly going over the switches, buzzers, bells, etc., to see that they are in good operating condition.

Simplicity is important because undue complications in the wiring are difficult for an electrician who is new to the job to follow. Consistent with the operating

conditions to be met, a system should be as simple as possible to accomplish the purpose for which it is designed. Necessarily a wiring layout for a three-compartment shaft with two hoists is more complicated than one for a single-compartment shaft.

SELECTING THE CIRCUIT LAYOUT

As a typical example of how the circuit layout may be chosen the work of the Copper Range Company at Painesdale, Mich., is given because of the writer's familiarity with the design of these systems, which were laid out for 5,000 ft. (1,524 m.) of depth.

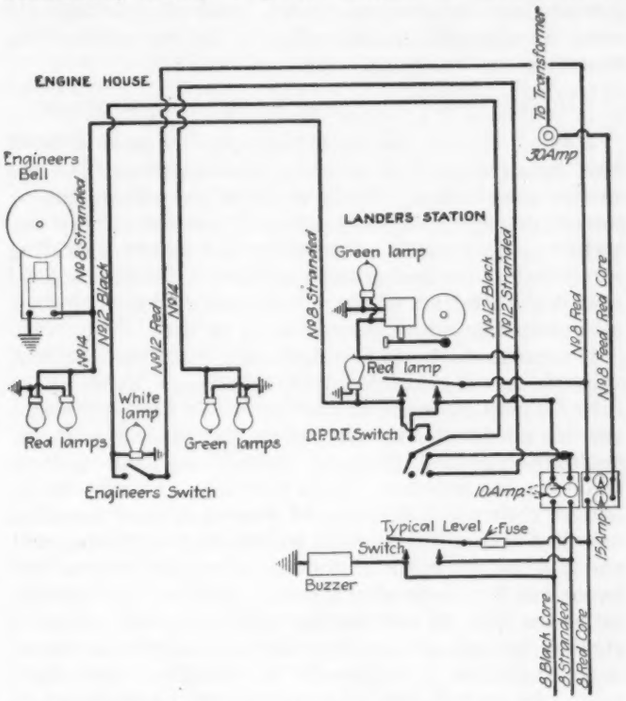


FIG. 1—SYSTEM FOR A TWO-COMPARTMENT SHAFT RINGING ON ONE SIDE ONLY

The sender of a signal hears the signal repeated back by the buzzers at each station. This system was developed by the Copper Range Company, Painesdale, Mich., all buzzers, switches and bells being built in the company shops.

In this district a "lander" is used who does all signaling to the engineer, and, with the idea of relieving the lander of Sunday work and of the possible elimination of that post, it was thought desirable to design the system for dual operation, *i.e.*, straight from underground or through the lander. In each case, however, the signals were to be repeated back underground before moving the hoisting engine.

Referring to Fig. 1, it will be seen that the underground circuit consists of three wires and a ground return. As the shaft is a two-compartment shaft with ringing for one side (*i.e.*, to ring the north side up, ring the south side down), there is one bell in the engine house and one for the lander. The wires therefore consist of a feed, a bell wire and a buzzer wire, using the ground return for both the bell and the buzzer circuit.

With the double-throw switch in the lander's station in the down position the operation is as follows: On closing the level switch buzzers on every level buzz, the lander's bell rings and a set of green lamps light up in the lander's stations. A set of four green lamps in the engine house also light up, giving the engineer a preliminary signal. On receiving the signal the lander repeats the signal to the engineer, causing the bell to ring and red lamps to light in the engine house. At the same time, however, the current flows back down the buzzer wire and all buzzers operate in the mine. As the lander rings the engineer red lamps light in the lander's station, showing him that the signal system is operating correctly. The sender of the original signal knows that his signal has been correctly sent as he hears the identical one sent to the engineer by the lander. The engineer had a check signal on his green lamps, and if the signal from the lander should not agree the error would be very evident. Three men are therefore on the job and each knows what is going on. If by any chance the signal is not correct as repeated back, the sender has an opportunity to stop the movement of the hoist.

If it is desired to ring direct from underground to the engineer, the double-throw switch in the lander's station is thrown in the up position. In this case as soon as the switch at a level is closed current flows up the bell wire directly to the engineer's bell, lighting the red lamp in the lander's station and also the red lamps in the engine house. It will be noted that in this case the green lamps are entirely cut off as the circuit is open when the switch is thrown into the up position. By following up the buzzer wire and passing through one pole of the switch it will be found that this wire also goes to the engine house, for a white light in this case. As the buzzers operate underground this light lights up, showing the engineer at once that the signal on his bell came directly from under ground. By using the switch on his stand he repeats the signal back. While the engineer thus has definite knowledge that the system is operating direct from under ground, the lander always notifies him of the throwing of the switch making the change.

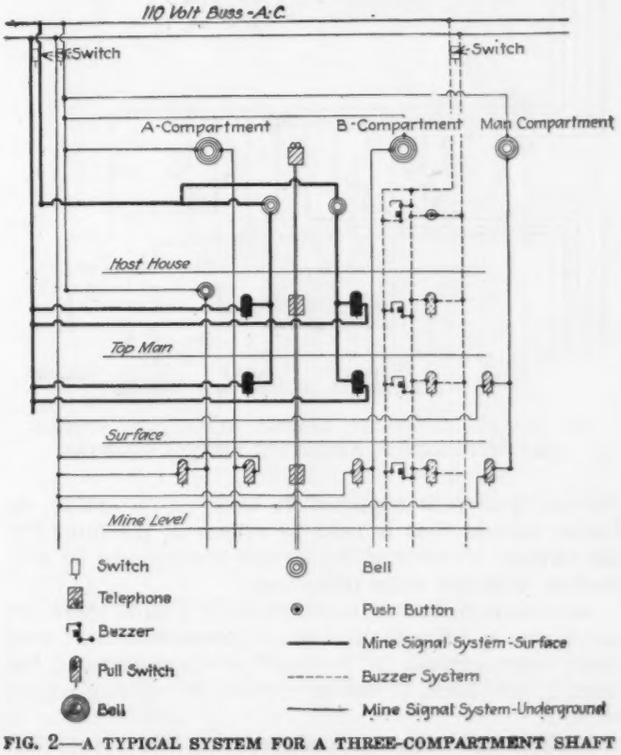


FIG. 2—A TYPICAL SYSTEM FOR A THREE-COMPARTMENT SHAFT

This system is used by the East Butte Copper Mining Company at the Pittsmount mine, Butte, Mont. There is a bell in the engine house for each compartment and two hoists. One hoist is for a single compartment of the shaft used to transport men and materials.

In this layout the telephone system has no part as it is entirely independent. In some installations the telephones are a part of the circuit system, the wires running in the same conduit or cable. It is the belief of the electrical department of the Copper Range Company that the two systems should be entirely independent and have no related functions. While there is additional expense involved in such a scheme, it does away with the possibility of electrical troubles on the signal system putting the telephone service out of commission. In the telephone system of this company it is possible to talk from any surface location to about every third level in all shafts.

In the Butte district operations are carried out differently from methods in the Michigan copper country. A typical example of a more complicated system is shown in Fig. 2 for the Pittsmont mine of the East Butte Copper Mining Company. There are in this case two distinct types of signals: (1) the signals that the station tenders use to connect with the hoisting engineer and top man and which no one in the mine except the

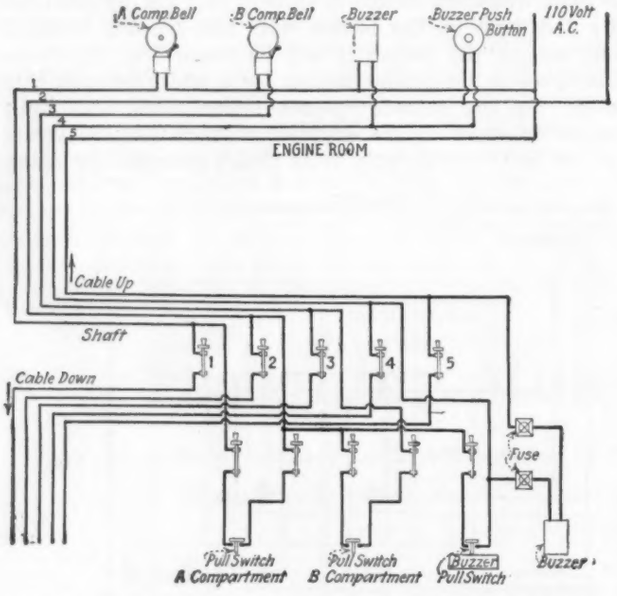


FIG. 3—ONE METHOD OF LOOPING CABLE INTO STATION JUNCTION BOXES TO FACILITATE TROUBLE SHOOTING

station tenders is supposed to use; (2) a system of buzzer signals that is used by others in the mine for the purpose of getting the station tenders and in connection with the mine telephones.

As shown in the wiring diagram in Fig. 2, there are ten wires, as follows: East shaft compartment, 1; west shaft compartment, 1; "chippy" compartment, 1; top man, 1; telephone, 2; buzzer system, 3; common return wire, 1.

Each compartment of the shaft has a separate bell in the engine house, and all pull switches operating in their respective compartments are in multiple. The buzzer system used for signaling station tenders and top men and also as a call for the mine telephone consists of one buzzer on each level, one at the surface and one in the engine room. All buzzers operate when any buzzer switch is closed.

A system for a two-compartment shaft with a separate bell for each compartment is shown in Fig. 3. This system is in use at the Butte & Superior Mine, Butte, Mont. From the sketch it will be seen that the general wiring scheme comprises one wire No. 2 as a common return wire, wires No. 1 and No. 3 as bell wires, and No. 4 and No. 5 taking care of the buzzer circuit.

Pull switches are placed upon each level and in skip pockets within easy reach of the cage tenders. There are also a buzzer and push-button on the engineer's stand. In case of a misunderstanding of signal the engineer can call for the signal to be repeated. The buzzers are independent of the hoist signals and are used for signaling cage tenders or by the engineer as stated.

RELIABILITY OF EQUIPMENT EXTREMELY IMPORTANT

Having chosen the circuit layout, the most difficult part remains, that of selecting the equipment and the proper installation. While working the circuit out on paper and laying out just what it is to do is very important, the problem of meeting the severe operating conditions is the real stumbling block. The next logical step is the selection of the voltage and deciding whether alternating or direct current is to be used.

Numerous systems are operating on direct current through motor-generator sets or storage batteries or both. There are some advantages to be gained through the use of direct current, but on the whole the use of ordinary standard 60-cycle, 110-volt lighting current simplifies the problem. With the large systems electrified as they are continuity of service is very essential to other operations as well as the signal system, and possible interruptions of the signal supply become less important if a mechanical signal is used for emergencies. In mines that do not use the wire rope pull bell as a standby but use an auxiliary electric system for emergency the point is, and should be, considered more carefully. In such a case the system can be designed to operate on either current, storage batteries being used for emergency.

Single-stroke bells seem to be far more desirable for signaling work of this class than the vibrating type. The strokes being distinct and easily read, code signals with slight time intervals can be used. In the Michi-

COST DATA FOR A 3,000-FT.-SHAFT SIGNAL SYSTEM, CHAMPION COPPER COMPANY, PAINESDALE, MICH. (1918)

Underground Feed:		
3,000 ft. 1-in. conduit, at $170 per 1,000 ft.	$510.00	
9,000 ft. No. 8 R.C. wire, at $33 per 1,000 ft.	297.00	
30 PRX junction boxes, at $3.48 each	104.40	
Fiber cleats, 30, at 20 cents each	6.00	
Labor (timber men on conduit and boxes), three men at $4.75, two shifts	28.50	
Labor (electricians, pulling main feeds), three men at $4.25, two shifts	25.50	
		$971.40
Underground Stations:		
Switch and buzzer units, 29, at $26 each	$754.00	
Labor of installing, $1.25 each	36.25	
		790.25
Lander's Station:		
Material (wire, small switches, etc.)	$3.00	
Signal switch	12.00	
Lander's bell	25.00	
Labor two men, two shifts, at $4	16.00	
		56.00
Engine-House Wiring:		
100 ft. 1-in. conduit, at $17	$17.00	
300 ft. No. 8 R.C. wire, at $3.30 per 100	9.90	
Signal switch	12.00	
Engineer's bell	30.00	
Material miscellaneous	5.00	
Labor, two men, five shifts, at $4	40.00	
		113.90
Line Work Between Shaft House and Engine House:*		
500 ft. No. 6 W. P. wire	$20.00	
2,000 ft. No. 8 iron wire	26.00	
Labor, two men, one shift, at $4	8.00	
		54.00
Grand total		$1,985.55

*Pole line already built.

gan district the half bell is used extensively, in which case the hoist is moved slowly until the switch is released and the bell plunger or core drops back. The Copper Range Company has developed a powerful engineer's bell of this single-stroke core type with an 18-in. (45-cm.) gong. The lander's bell is a smaller, slightly different type using a 6-in. (15-cm.) gong.

The weakest part of a signal system is usually the underground stations. Rugged switches for this service have been developed by the mining companies as commercial designs have not stood up under the service in most cases. There is, however, an evident need for improvement as most companies would rather buy such equipment than build it themselves.

In Fig. 4 is shown the underground switch and buzzer unit developed by the Copper Range Company. The switch makes and breaks in oil and all parts are built to stand hard service. Brass is used where corrosion might affect the working action. As shown in Fig. 4, this switch and the buzzer are mounted on a creosoted 2-in. (5-cm.) plank as a standard station unit. The switch may be held in the closed position by means of the latch *A*. While the switch is in this closed position all of the buzzers in the mine are sounding a warning that the hoist is being held. It would not be possible, however, to signal the engineer by closing any other switch.

Oil switches are used for several reasons. There is always a certain amount of arcing connected with breaking a solenoid circuit, and in time this arcing burns through the contacts. Breaking the arc in oil eliminates this source of possible trouble. The oil also lubricates the bearing surface of the plunger and prevents dust from making the switch sluggish. In case the switch is not operated for long periods of time the oil protects the contacts and spring from corrosion.

Buzzers suitable for mine use have been developed commercially within recent years. They should be very rugged and as nearly waterproof as possible. No adjustments should be required and the life of the tongue should be as long as possible. The tone should not be unpleasant. The one shown in Fig. 4 is built by the company and meets these requirements.

PROTECTING SHAFT CIRCUITS

Two methods of installation are in use for placing signal circuits in the shaft, one lead cable and the other conduit. In either case all wiring should be totally inclosed from the engine house to the last shaft station. Lead cable has the advantage of being waterproof provided that the entrances to junction boxes, buzzers and switches are also water-tight. Conduit circuits have given good service in a great many cases and afford an easier method of pulling out a section for repairs. In the Butte district the practice has been to favor the lead cable for signal use. In the Michigan mines conduit is used. By placing junction boxes at every level with a conduit union above the box sections can be taken out very easily in case of grounded circuits. Mechanical strength is essential, and partly for that reason No. 8 rubber-covered wire in 1-in. (2.5-cm.) conduit has been used in the system of the Copper Range Company.

TROUBLE SHOOTING MADE EASY

To facilitate the location of troubles arrangement should be made for sectionalizing the line. In Fig. 3 this is done by the use of single-pole knife switches in the junction boxes. Each wire may be disconnected from the lower levels and by another switch from the circuit on that level. In the system of the Copper Range Company terminal lugs are used in the junction boxes instead of switches. In case of a ground on a wire in a 3,000-ft. (900-m.) shaft the line is opened at the 1,500-ft. (450-m.) level. If the trouble remains it is evident that the location of the ground is in the upper half. By repeating the sectionalizing the point may be located within a few levels. By climbing the ladders and making an inspection of each station the trouble can usually be found quickly.

Fuses should be so arranged that protection will be had on all parts of the circuit and in such a way that a blown fuse will indicate which wire is grounded.

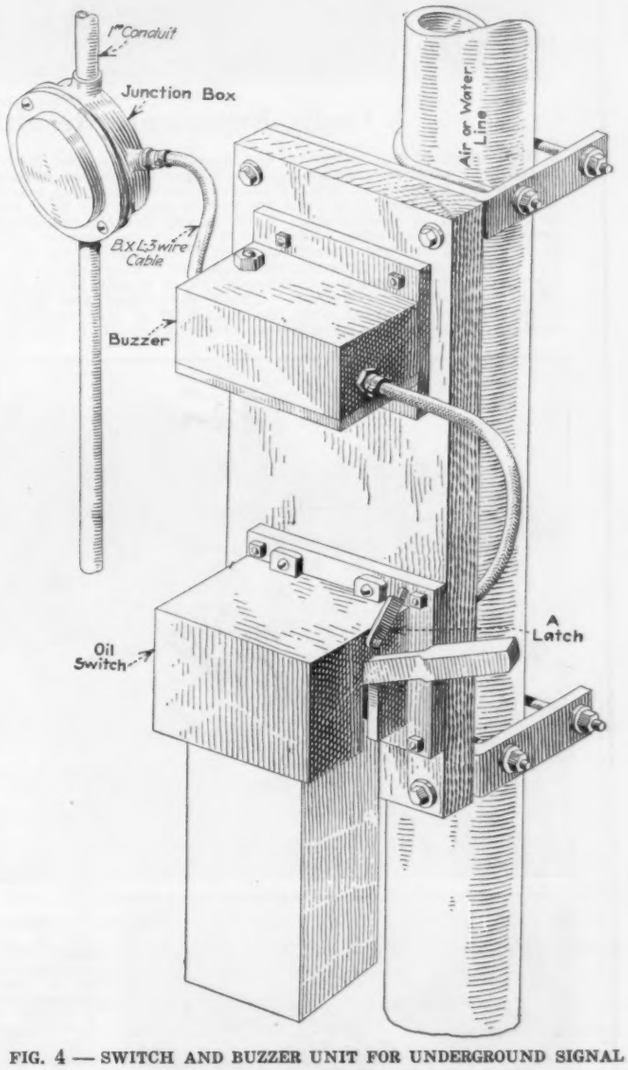


FIG. 4 — SWITCH AND BUZZER UNIT FOR UNDERGROUND SIGNAL STATIONS, SHOWING METHOD OF MOUNTING

First cost of a system is usually indicative of careful thought. It may be the most economical expenditure in the course of time. The system of the Copper Range Company showed a cost of approximately $1,930 in 1918 for a 3,000-ft. shaft, including everything except a few minor miscellaneous items. All bells, buzzers and switches were built in the shops of the company and all materials were of the best. There has been virtually no maintenance expense since the first installation in 1916, with five shafts now in operation.

A Costly Experience Resulting from Political Interference

Regardless of the integrity, engineering ability and desire of the head of any municipally owned light and power system to keep his department free of politics, the engineering which may be done under this form of ownership cannot help but be influenced by politicians. Even in the Seattle municipal system, which has often been referred to as the highest type of municipal electric operation, and which has at its head J. D. Ross, a very progressive engineer, this condition has occurred and resulted in an expenditure of nearly $4,000,000, which is drawing no return. There the public and politicians were not content with the judgment of the municipal electric department and allowed interference that resulted in an unsound hydro-electric development on Cedar River, which culminated in two disastrous floods in 1918. Attempts to prevent repetition of the trouble have proved futile and costly, and the present outlook is that a large investment has been thrown away. As pointed out in the May 1, 1920, issue of the ELECTRICAL WORLD, Mr. Ross has proposed a solution which will at least enable the city to use its Cedar River power plant, but politics again is raising obstacles. A privately owned utility, which has a constant incentive to make no useless expenditures of money or unsound developments, would have avoided this situation, which the city of Seattle will now have to absorb in taxes or higher rates.

1. Cedar River dam and a portion of the basin above, the far embankment of which is a glacial moraine through which the impounded water filtered and caused two disastrous floods in 1918. Some results of this catastrophe are shown below. Attempts to seal this basin have been futile, and as a result practically no water is being stored behind the dam, which cost $1,700,000. To this cost must be added interest to the maturity of the bonds, $1,260,000; the cost of unsuccessful sealing operations, $382,000, a bond issue of $175,000 to pay the cost of the first flood, and the interest to maturity on this bond issue of $72,187.50. In addition there are suits pending for the second and most disastrous of the floods for an amount of $500,000, which, if Seattle is held liable, will cause a total loss from this municipal adventure of more than $4,000,000.

Protection of Transmission Systems—II

A Comprehensive Analysis of Abnormal Voltages Which May Occur on Transmission Systems and Methods Adopted by a Company in Sweden to Protect Station Apparatus from Insulation Break-down

By PROF. EMIL ALM

THE protection of overhead transmission systems against voltages developed by atmospheric disturbances and grounding of a line conductor and excessive voltage rise at the neutral were considered by the author in the first part of this article, published in the ELECTRICAL WORLD for Aug. 7. It is now the purpose to consider the nature of traveling waves and means of controlling them. As previously mentioned, traveling waves will be produced both when atmospheric static charges are set free, occur when an insulator string flashes over. As these are designed for a flash-over of about 250,000 effective volts, traveling waves will propagate to either side of the flash-over point (Fig. 2), having an amplitude of $(250{,}000/2)\sqrt{2} = 125\sqrt{2}$ kv. and a voltage jump of twice this value, or $250\sqrt{2}$ kv. The doubled potential change caused by the reflection of such a wave with an amplitude of $250\sqrt{2}$ kv. is usually considered as the highest voltage jump which can occur, except those due

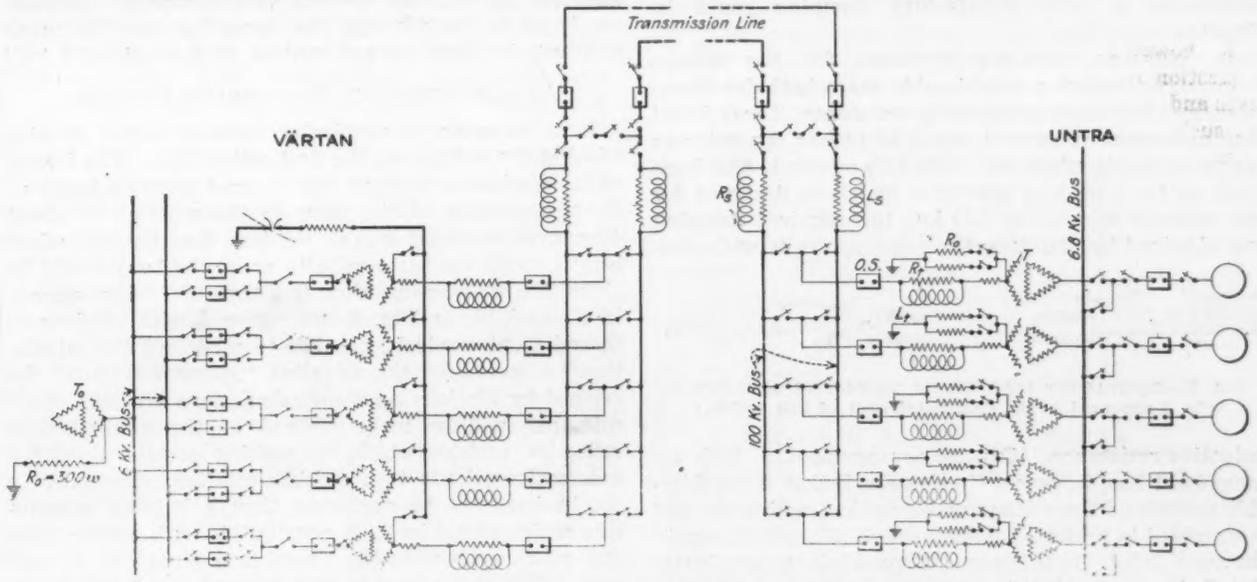


FIG. 1—CONNECTION SCHEME FOR PLANT AND TRANSMISSION SYSTEM AT UNTRA, SWEDEN

Abbreviations: *OS* = oil circuit breaker; *T* = transformer; L_t = transformer inductance coil; R_t = shunt resistance for same; L_s = line inductance coil; R_s = shunt resistance for same; R_o = neutral resistance; T_o = transformer neutral resistance. The generating station is connected to Värtan over 100-kw. transmission lines.

whether these are accompanied by grounds or not, and by switching, short circuits, etc. These waves travel along the lines with a comparatively steep front and when they reach the transformer windings may cause the break-down of the latter. Condensers could hardly be used as a protection against over-voltages of this nature, so that, besides a heavy insulation between the turns and layers of the windings, reactance coils must be resorted to.

For transformers of the size involved there is no difficulty in providing such a heavy insulation at a reasonable cost, and this has been considered the most important means to prevent operating disturbances caused by traveling voltage waves. Space has, however, been provided for reactance coils both for the incoming lines and for each transformer, although these coils have not as yet been installed.

EVALUATION OF DISTURBANCES CAUSED BY TRAVELING WAVES

Comparing the amplitudes of the traveling waves which can be set up from switching or other operating disturbances, it has been found that the worst results to direct lightning strokes, and the highest for which protection should be provided. The transformers are constructed with a 2-mm. paper insulation between the winding turns, and one-tenth of the winding nearest the terminals is strengthened to 2.65 mm. The distance from copper to copper in the coils nearest the terminals is 20 mm. and is thereafter reduced to 11 mm. in the ordinary coils. For a minute's test this should correspond to a dielectric strength of 60 kv. and 75 kv. respectively for the insulation between the turns and about 135 kv. and 80 kv. respectively for the insulation between the coils. For momentary stresses it may be assumed that the dielectric strength of oil is from two to three times greater than for a continuous stress, depending on the distance, and for solid dielectrics it is even greater.

Starting out from the fact that the voltage jump of a reflected wave would correspond to about 500 kv. effective, it would seem as if the insulation used would be insufficient, provided that we considered the transformer winding as a straight line of high resistance against the wave. If, on the other hand, we take the

capacity between the turns into consideration, the conditions will be more favorable, at least for the insulation between the turns. The momentary stress between the turns nearest the terminals has been calculated to approximately 60 kv. effective. The first coil will, however, take up almost the entire voltage jump of the wave, so that the weak point in a transformer will undoubtedly be found in the insulation between the coils. On this account the installation of reactance coils as a further protection has been considered, as previously mentioned.

Inasmuch as both theoretical investigations and experiments have shown that with undampened reactance coils the amplitude of the overvoltages in certain parts of the switch-house could increase considerably above the amplitude of the primary disturbance, it was from the beginning clear that some sort of damping device had to be provided. Calculations were made for a damping device consisting of a horn-gap arrester and a resistor and these showed that with suitably dimensioned resistances a fully satisfactory damping could be obtained.

As, however, horn-gap arresters for the voltage in question require a considerable space both for themselves and for the accompanying resistance, it was found that such an arrangement would be rather expensive as compared to its advantage. On this account, and inasmuch as the lines and apparatus had been designed for test voltages as high as 250 kv., the required damping was obtained by shunting the reactance coils with non-

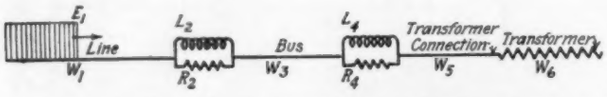


FIG. 3—EQUIVALENT DIAGRAM OF PROTECTIVE APPARATUS
(Fig. 2 appeared in the first installment of this article.)

inductive resistances (Campos arrangement). This arrangement has, however, the drawback that a considerable portion of the voltage wave, against which the coil is supposed to protect, passes through without change in the wave front. On this account space has, as previously stated, been provided for reactance coils for each line and each transformer (Fig. 1). A protective system is obtained, therefore, equivalent to that shown in Fig. 3 in which W also indicates the wave resistances.

If, in the first place, we assume the inductances L_2 and L_4 so high that the wave passing through them can be neglected, then the amplitude of the wave which goes to W_3 through the shunt resistance R_2 is:

$$E_3 = \frac{2W_3}{R_2 + W_1 + W_4} E_1$$

When this wave in turn passes the shunt resistance R_4 to the reactance coil of the transformer, then the wave passing to W_5 will have an amplitude of:

$$E_5 = \frac{2W_5}{R_4 + W_3 + W_5} E_3$$

For atmospheric disturbances we can put approximately, $W_1 = 700$ ohms, $W_3 = W_5 = 300$ ohms. The length of $W_3 = 100$ m. and of $W_5 = 10$ m., and their capacities approximate 10×10^{-10} and 1×10^{-10} farad respectively.

The resistances R_2 and R_4 should now have such values that the charging of the transformer does not take place in an oscillatory manner, but aperiodically. On the other hand, they should be as large as possible in order that the voltage let through shall not have too high an amplitude. Their size depends, therefore, to a great extent on the size of inductances L_2 and L_4. As the maximum energy of the wave is absorbed in a shunt resistance when its resistance in ohms is equal to the sum of the wave resistances on either side, we get

$$R_2 = 700 + 300 = 1{,}000 \text{ ohms.}$$
$$R_4 = 300 + 300 = 600 \text{ ohms.}$$

With the above values for W and R, we get:

$$E_3 = 0.3\ E_1$$

and

$$E_5 = 0.5\ E_3 = 0.15\ E_1.$$

When this wave reaches the transformer W_5, practically a doubling of the voltage occurs, so that the first wave which enters the transformer has an amplitude $0.3E_1$. If, therefore, E_1 equals a voltage wave of 250 kv., then the transformer winding will be exposed to a voltage of about 75 kv. On account of the capacity between the turns of the winding the stress between the turns will only be about 12 per cent of this, or about 9 kv.

VOLTAGE STRESS ON TRANSFORMER END COIL

It is, however, of particular interest to get an idea of what the voltage on the first coil will be. The length of its conductor is about 120 m., and if the velocity of the propagation of the wave in the winding is about 40 per cent of what it is on the bus, then the equivalent length (with the same velocity as on the bus) would be about 300 m., corresponding to a time of 1 micro-second. If W_3 and W_5 in Fig. 3 are replaced with condensers C_3 and C_5, it would be possible to carry out the calculation by means of the so-called "operator-method" developed by Pleijel. As these calculations are very intricate, use will be made instead of the method with reflection factors, which, by making certain simplified assumptions, leads to a quicker solution. Damping in the busbars will be neglected, though it is an assumption which would be fully permissible with copper bars, and which even with the heavy iron pipes—$1\frac{1}{2}$ in. and 1 in. (3.8 cm. and 2.5 cm.) respectively—which are used in this case can be considered altogether unfavorable.

On W_3 the charge oscillates between R_4 and W_5 and will in one second make fifteen complete oscillations. Inasmuch as the reflection factor between W_3 and R_4 is, approximately,

$$K_{r54} = \frac{R_4 + W_3 - W_5}{R_4 + W_3 + W_5} = 0.5,$$

and the reflection factor between W_5 and W_6,

$$K_{r56} = 1,$$

the result of the first impulse after fifteen oscillations will be

$$0.15 E_1 \frac{(1 + K_{r56})}{(1 - K_{r54} K_{r56})} [1 - (K_{r54} K_{r56})^{15}] = 0.6 E_1.$$

During ten oscillations on W_5 the charge on W_3 has made one oscillation. As the reflection factor between W_3 and R_4 is

$$K_{r34} = \frac{R_4 + W_5 - W_3}{R_4 + W_5 + W_3} = 0.5$$

and between W_3 and R_2

$$K_{r32} = \frac{R_2 + W_1 - W_3}{R_2 + W_1 + W_3} = 0.7.$$

the next impulse which from W_3 reaches W_4 will be:

$$0.15E_1 \times 0.5 \times 0.7 = 0.35 \times 0.15E_1.$$

After five oscillations (15 — 10) it will have a value:

$$0.35 \times 0.15\,E_1 \times \frac{2}{0.5}(1 - 0.5^5) = 0.2\,E_1.$$

The total voltage to which the first coil is subjected will therefore be about

$$E_{s_1} = (0.6 + 0.2)E_1 = 0.8\,E_1,$$

or if $E_1 = 250$ kv.,

$$E_{s_1} = 200 \text{ kv.}$$

If we take into consideration that part of the waves even enter the inductances and that a certain damping takes place when the waves pass back and forth on the busbars, the voltage across the first coil will be somewhat less. The assumptions made in order that this calculation shall be fairly accurate are, besides the neglecting of the damping effect, partly that the resistances can be considered as "concentrated" and partly that the "equivalent" conductor length of the inductances is greater than the equivalent conductor length of the first transformer coil, or, in other words, that the time it takes for a wave to pass either coil shall be more than 1 micro-second. If we assume that the velocity of propagation in the reactance coil and the transformer winding is the same, their actual conductor length must therefore be greater than the first transformer coil.

As the above value of the voltage between the first and second coils is on the safe side and as the stress is only of short duration, there is every reason to believe that the insulation provided between the transformer coils is sufficient. It is, for that matter, not necessary to make the charging fully aperiodic, as it can very well be somewhat oscillatory. On this account the size of the shunt resistances can be considerably increased (50 to 100 per cent) without materially increasing the pressure rise. If for example R_2 and R_4 were doubled, then the voltage on the first coil would be about $0.6E_1$ instead of $0.8E_1$ as in the previous case: that is, 150 kv. instead of 200 kv. The size of the inductances should then strictly be increased in proportion to the square if an aperiodic charging be still desired, but, as already mentioned, this is an unnecessarily severe condition.

Iron Piping Considered for Inductance Coils

It had originally been planned to make the inductances relatively large (10 to 20 milliheuries) and of copper. On account of the favorable influence which the capacity between the turns has proved to have on potential stresses, it is safe to say that these values can be reduced. As it has furthermore been shown that iron conductors have a much higher damping ability than copper, it is under consideration to substitute coils of iron pipe for the copper coils. On account of the increased losses and in order to get them into the compartments already provided, these iron coils would have to be made for considerably lower inductance; but, on the other hand they have a much more powerful damping effect on the traveling wave.

The resistances should, as already mentioned, have as short a conductor length as possible. It would be best if this could be made of rods of some material with high resistance, for example, "silit." Experiments have, however, shown that "silit" exposed to the pressure shocks of traveling waves to a considerable degree loses its resistance, and this material is therefore unsuitable. Another method would be to deposit spirally a thin layer of some metal with high resistance on a porcelain rod, for example, platinum. The simplest way is, naturally, to wind fine high-resistance wire on some kind of insulating rod, such as porcelain, bakelite, etc. In that case, however, the resistance conductor will be rather long. If the inductance coils are made of iron pipe, it is not out of question, however, that the damping which would be obtained owing to the high current density would be sufficient to prevent pressure rises above the amplitude of the primary disturbance.

In this connection it may be mentioned that the high-voltage oil circuit breakers are provided with charging resistances for reducing the current shocks from cutting in transformers and for reducing the traveling waves caused by switching.

Resonance Due to Harmonics in the Generator Voltage Wave

With the rotor removed each generator has a leakage reactance of 0.799 ohm. With the rotor in place the leakage reactance may be assumed to be 0.6 ohm.

With transformer ratio at Untra equal to 15, the generator reactance corresponding to the high-voltage side $= 15^2 \times 0.6 = 135$ ohms, and the inductance is:

$$L_g = 135/2\,\pi\,25 = 0.86 \text{ henry.}$$

To this must be added the leakage reactance of the transformer, which, measured on the high-tension side, is 78 ohms, corresponding to a reactance of

$$L_t = 78/2\,\pi\,25 = 0.5 \text{ henry.}$$

For each unit the total leakage reactance per phase is thus:

$$L = 0.86 + 0.5 = 1.36 \text{ henries.}$$

The capacity per phase of either line is figured to be 1.17 m.fd. at 100,000 volts and normal frequency, corresponding to a charging current of 10.6 amp. Neglecting the magnetizing inductance of the transformer as compared with the capacity which is permissible with frequencies higher than normal, the natural period of the system will be:

(a) With one unit and two lines = 89.5 periods.
(b) With one unit and one line = 126.5 periods.
(c) With two units and one line = 179 periods.

The natural period in cases *b* and *c* corresponds approximately to the fifth and seventh harmonics.

On account of the relatively low natural period it is important that the generator voltage wave be free from harmonics. At no load this is the case, but when loaded the armature reaction always causes a certain deformation of the voltage curve, the more so the higher the armature magneto-motive force is in proportion to the field. As the generators are designed with a comparatively strong field, the danger from this should not be great, and this is borne out by the operation.

With grounds, and especially with single-phase short circuits, a considerable deformation of the voltage wave will take place due to the unsymmetrical (single-phase) load. With single-phase short circuits the peak value of the voltage of the unloaded phase will rise considerably, especially if the transformers are Y-connected on both sides. As the transformers in this case are Y-Δ connected, the voltage rise due to the latter cause will be

somewhat reduced. If, however, the causes should bring about any troublesome deformation of the voltage wave, the generators are so constructed that an effective damping winding can readily be provided on the field and thus reduce any deformations caused by an unsymmetrical or single-phase load.

PROTECTION AGAINST OVERVOLTAGES PASSING FROM HIGH TO LOW VOLTAGE SIDE

With a ground on one leg of a line the voltage of the other legs will rise, and if the capacity between low-tension winding of the transformers and ground is small, quite a high voltage can be statically induced on the corresponding low-tension winding. As, however, the low-tension windings both at Untra and Vartan are connected to cables with a relatively high capacity, the pressure rise that is due to this cause would be negligible.

It would be more dangerous if the voltage should strike over between the high-voltage and low-voltage windings through the transformer cover or case, for example. To avoid the triple harmonics which may occur if a three-phase transformer of high saturation has both its windings Y-connected, the transformers at Vartan have been delta-connected on the low-tension side and Y-connected on the high-tension side. There is therefore no neutral point on the 6,000-volt side which can be grounded and whereby, with flash-over between the windings, a pressure rise on the cable system may be prevented. For this reason there is connected to the 6,000-volt busbars at Vartan a Y-connected reactance coil whose neutral is connected to ground through a 300-ohm resistor, this resistance being necessary to prevent a short circuit of one phase of the reactance coil in case of a ground in the cable system.

If, owing to a flash-over from the high-tension side, the voltage of the cable system rises, currents will be set up through the three phases of the reactance coil and through the resistance to ground, and these currents will limit the pressure rise. In order, then, that the inductive voltage drop in reactance coil shall not be too great, it is besides provided with a delta-connected winding without any leads. In this manner the voltage drop in the coil will only be equal to the short-circuit voltage. In Untra, however, provision has been made for grounding the generator neutrals to prevent such pressure rises.

The foregoing is a condensed translation by Eric Lof of a lecture delivered by Professor Alm before the Electro-Technical Society of Stockholm.

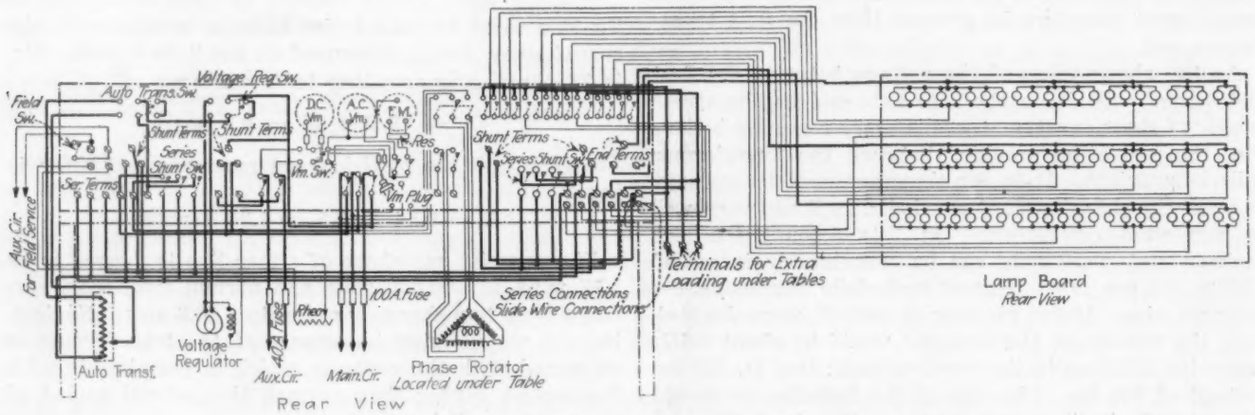
Polyphase Experimental and Instrument-Testing Table

By Means of Large and Well Designed Board All Needed Values May Be Obtained with Minimum of Space and Equipment

BY H. P. SPARKES
Engineer Westinghouse Electric & Manufacturing Company

IN THOROUGH testing of electrical instruments all possible operating conditions must be reproduced in order that there shall be accuracy when the devices are placed in actual service. For alternating-current instruments there must be tests of loads, voltage, frequency and power factor. Usually a great amount of apparatus is necessary for this work and the space taken by this equipment is somewhat large. These problems have been greatly simplified by means of a testing table recently built which makes it easy to obtain all needed values. In particular, the board is specially suitable for making wattmeter tests when the power factor, voltage and load must be changed, or for the testing of power-factor instruments or other phase-indicating devices.

As shown, the table is equipped with switching apparatus mounted on vertical panels at the back with plenty of room on top of the tables for instruments to be tested. Three sections of oil-finished slate are used, each section being a standard 2-in. (5-cm.) panel. The sections are laid out so that apparatus which has related usage is grouped together. Regulators, rheostats and similar instruments are mounted under the top of the table, so that the control handles are convenient to the operator when standing near the center in a position to read the instruments or make other adjustments. The framework of the table and panel supports are of hardwood, thus making a minimum of iron. The table top is of hardwood 2¼-in. (5.6 cm.) thick, highly polished so as to present a clean surface and avoid accumulation of dust.



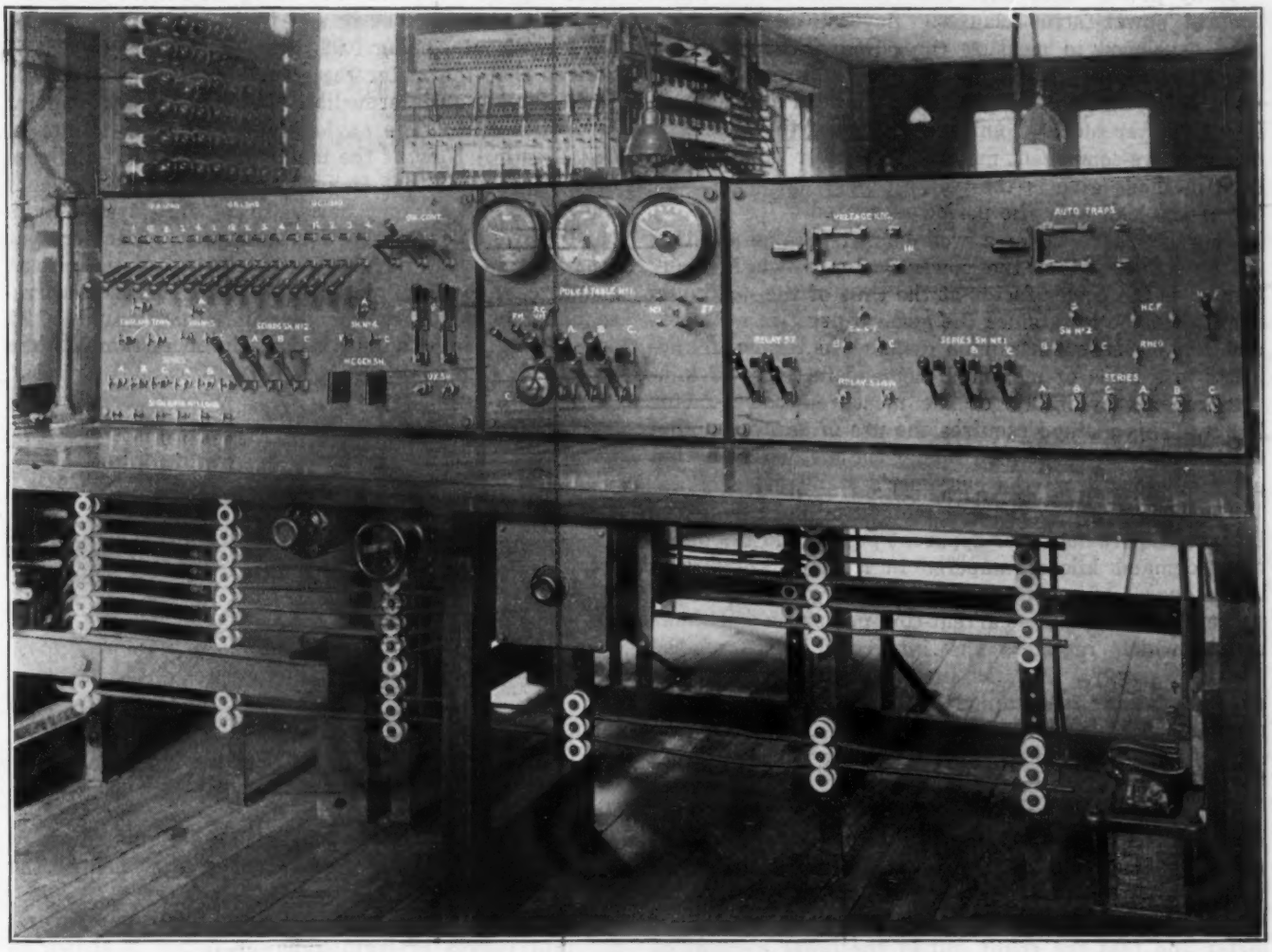
CONNECTIONS ON BACK OF POLYPHASE INSTRUMENT TESTING BOARD

The table is designed to accommodate one three-phase circuit and two auxiliary single-phase circuits. The three-phase circuit is the main testing circuit and is connected to all apparatus on the test table, whereas the auxiliary circuits are connected only to separate switches and terminals. These auxiliary circuits may be used for the field control of machines supplying power to the testing table, or where two sources of power are necessary for testing. In all cases the auxil-

iary circuits are connected to the power-supply switchboard or directly to an independent source of power.

The general connections are as follows: The energy supply is connected to the table by means of a three-phase circuit. This circuit is protected by fuses of 100-amp. capacity. At the point where the main switches are connected in the circuit are taps for the instruments mounted on the table. Each instrument is supplied with independent cutout switches, and a master phasing plug controlls all instruments. This arrangement makes it possible to determine the conditions existing in each phase before closing the main-line switches for the test. On the table side of the main switches are taps for shunt connections, and auto-transformer and voltage regulator, a set of series terminals and shunt switches, and a second set of shunt terminals is also connected. At the other end of the table the connections of the shunt and series terminal combinations are practically duplicated, with the exception that the first shunt circuit is taken off after the auto-transformer and voltage regulator. The circuit passes on through the load switches and lamp or load bank. The load is kept separate and each phase end is connected to terminals on the table called "end terminals." This makes each phase independent throughout the board, and it remains so until the three terminals are connected either in star or delta, as desired. The delta connection requires each end terminal to be connected back to the proper phase at the main-line switch. This may be done through the first shunt taps taken off. Terminals for extra load are placed under the table, making it possible to insert various loads without the fine adjustment of the load-bank combination. The first switch of each load group has terminals for connecting a slide-wire resistance in series in order to obtain very fine adjustment. The phase shifter is connected direct to the three-phase circuit; in the secondary is an extra set of terminals and switches. The rheostat is connected to terminals just below the terminals of one of the auxiliary circuits so that it may be used for controlling the source of power.

The auxiliary circuits are equipped with separate switches and terminals. One circuit has a capacity of 40 amp., making this circuit serviceable for auxiliary work in connection with a test. The second auxiliary circuit is supplied for field control or other light service.



BOARD WHICH FACILITATES POLYPHASE EXPERIMENTS AND TESTS

Referring to the front of the table, the left-hand panel contains the load switches, the phase-shifting switching equipment, two sets of shunt terminals, one set of series terminals and switches, the end terminals and the auxiliary load terminals. The middle panel, or the master-control panel, contains the frequency meter, alternating and direct current voltmeter, instrument switches, phasing plug and the main-line switches. The right-hand panel contains a switch for controlling the voltage regulator and the auto-transformer, main-line switches and terminals for 40-amp. auxiliary circuit, two sets of shunt terminals, one set of series terminals and switches, one switch and terminal for field-control auxiliary circuit and one set of terminals for the rheostat.

Establishing Simple Basis for Rates

Measurement of Kilovolt-Ampere-Hours and Kilovolt-Amperes Maximum Demand in Polyphase Circuits by the Use of Standard Polyphase Watt-Hour Meters Gives Simple Basis on Which to Figure Rates

By RAY H. WOLFORD
Assistant Engineer Meter Department American Gas & Electric Company, New York

THE recent tendency of central stations to take into consideration the power factor of their customers' loads in making rates has brought about the need of some means for arriving at a figure which could be used in such rates and which would represent the condition of a customer's load as regards the ratio of actual to apparent power.

Many power rates have been put into effect which contain power-factor clauses. Several methods have been developed to measure the power factor of loads, chief among which are the methods of measuring the reactive or wattless component of the load and computing the power factor from the readings of the watt-hour and reactive-component meters. The power factor which such methods give is the weighted average power-factor of the load over the period measured.

There appears to be a well-defined opinion existing in the industry that the power factor which is really wanted is the power factor at the time of the maximum demand of the load, since the general practice is to correct the measured maximum demand in terms of kilowatts to a basis of maximum demand in terms of kilovolt-amperes by means of the measured power-factor figure. This method requires the use of several mathematical calculations, which render the method somewhat unsatisfactory from the customer's standpoint.

The writer will describe a method of measuring the kilovolt-ampere-hours, or apparent power, and the maximum demand kilovolt-amperes in a polyphase circuit to the degree of commercial accuracy by use of a three-phase, four-wire, three-current-coil, polyphase watt-hour meter, which registers the integrated value of the apparent power. The maximum demand in terms of apparent power is obtained by the use of any of the ordinary block-interval demand meters on the market, controlled by the usual contact-making devices, or by being built directly in the integrating meter.

The manner of connecting the integrating kilowatt-hour meter and kilovolt-ampere-hour meter in a three-phase circuit is shown in Fig. 2. It may be observed that the top element of the kva.-hour meter is connected identically as the top element of the kw.-hour meter and that the shunt coil of the lower element of the kva.-hour meter is connected between Z and X instead of Z and Y, as would be the case in measuring power.

Had the phase rotation of the circuit been in the reverse direction the manner of connecting the elements would also have been reversed. The common return of the current transformers passes through the middle current coil of the kva.-hour meter where it joins the other current circuits. This common return is used in place of a third transformer as the current in it is equal to the current in the third wire of the circuit.

A constant of 0.577 (= 1.73/3) has to be used to reduce the dial reading of the standard meter to kva.-hours. However, this constant may be changed to unity by using a register on the meter having twice the ratio of the standard register and using a calibrating constant of 0.5/0.577 = 86.6 per cent of the standard constant.

The principle of the method is based on the fact that the current in the circuit may lead or lag any chosen position at which position the shunt and current fields of the meter are in a state of quadrature to the amount of 11 deg. 20 min., and in so doing only cause the meter to decrease 2 per cent in speed, the cosine function of 11 deg. 20 min. being 0.98. For example, suppose it is desired that the meter register over a range of power factor having an intermediate chosen power-factor point of 75 per cent. The angle whose cosine is 0.75 is 41 deg. 20 min. Now, if the meter is so adjusted and connected in circuit that at a power factor of 75 per cent the shunt and current fields are 90 deg. apart, or in quadrature, the meter will record volts × amperes at that power-factor. If the power factor of the circuit should change to 61 per cent or 86.6 per cent, corresponding to a shift of the current in the circuit of 11 deg. 20 min. in either direction, the meter would then

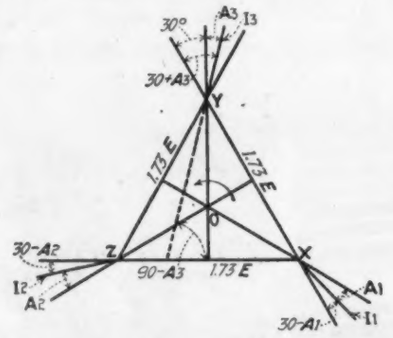


FIG. 1—VECTOR DIAGRAM OF A THREE-PHASE CIRCUIT X, Y, Z, HAVING A BALANCED DELTA VOLTAGE OF 1.73 E AND CURRENT VALUES I_1, I_2, I_3, IN THE THREE-PHASE WIRES

record volts × amperes × cos (11 deg. 20 min.) = 0.98 volt-amp., resulting in an error of 2 per cent in the registration.

The accuracy of the method when applied to several different ranges of lagging power factor is shown in Fig. 3. The meter and connection described are adapted for use over any of these ranges by adjusting the lag angle of the shunt fields of the meter. Each of the curves (Fig 3) has an intermediate power-factor point at which point the meter is adjusted so that a quadrature condition exists between the shunt and current fields when the power factor of the circuit is at that point. The odd lag angles of the shunt fields are secured by means of the quadrature adjusting device in the meter for angles larger than 90 deg. and by inserting a resistor in series with the shunt coils for angles less than 90 deg.

The five intermediate power-factor points, the corresponding lag angles of main-circuit current to the Y-voltage E, and the required shunt-field lag angles, are given in the accompanying table.

Referring to Fig 3 again, curve (3) is derived by the use of the standard meter with a lag angle of 90 deg. It will be noted that the meter has a much longer range within any chosen accuracy limits at the lower power factors. The small sharp curves represent the registration of a watt-hour meter expressed in terms of apparent power.

The registration of the watt-hour meter shown in Fig. 2 may be calculated on the basis of curve 3, (Fig. 3) as follows:

The element in X records proportional to

$$0.577 \times 1.73\ EI_1 \cos\ (30 - A_1) = 0.866\ EI_1 \cos A_1 + 0.5\ EI_1 \sin A_1.$$

The element in Y records:

$$0.577 \times 1.73\ EI_3 \cos\ (30 + A_3) + 0.577 \times 1.73\ EI_3 \cos\ (90 - A_3) = 0.866\ EI_3 \cos A_3 + 0.5\ EI_3 \sin A_3.$$

The element in Z records:

$$0.577 \times 1.73\ EI_2 \cos\ (30 - A_2) = 0.866\ EI_2 \cos A_2 + 0.5\ EI_2 \sin A_2.$$

Adding the registrations of the three elements, since their torques are exerted on a common shaft:

$$0.866\ EI_1 \cos A_1 + 0.5\ EI_1 \sin A_1 + 0.866\ EI_2 \cos A_2 + 0.5\ EI_2 \sin A_2 + 0.866\ EI_3 \cos A_3 + 0.5\ EI_3 \sin A_3,$$

which expresses the registration of the meter.

Assume angles A_1, A_2, A_3 to be any angles of lag between 18 deg. 40 min. and 41 deg. 20 min. corresponding to power factors between 94.7 and 75 per cent whose cosines are 0.947 and 0.75 and whose sines are 0.32 and 0.66. Substituting the values of the cosines and sines for 41 deg. 20 min. in the quantity it becomes:

$$0.98\ EI_1 + 0.98\ EI_2 + 0.98\ EI_3$$

and similarly the values for 18 deg. 40 min. may be used with the same result.

The true volt-amperes in the circuit is expressed by the quantity $EI_1 + EI_2 + EI_3$ since balanced voltage has been assumed.

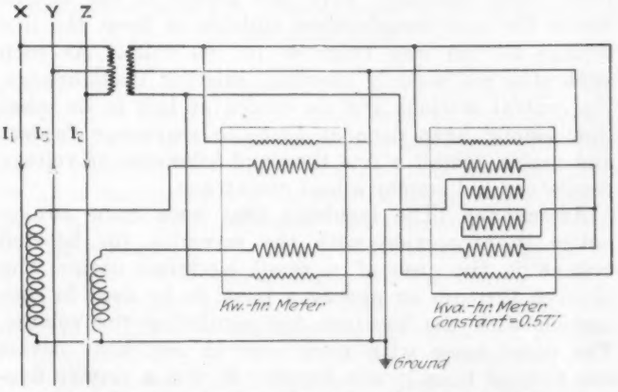


FIG. 2—METHOD OF CONNECTING STANDARD INSTRUMENTS FOR MEASURING POWER FACTOR

It is evident that at a power factor of 86.6 per cent, corresponding to a lag angle of 30 deg., the meter would register true volt-amperes. In the same manner it may be shown that at any other power factor of the main circuit, either leading or lagging, the meter may be adjusted so as to measure apparent power over a restricted range of power factor within the limits of commercial accuracy. For example, the standard meter with a 90-deg. lag angle may be used on a circuit having an intermediate power-factor point of 86.6 per cent leading by altering the method of connection of the shunt coils so that the voltage vectors will lead the current vectors by an angle of 30 deg. at unity power factor in main circuit.

Some difficulty may be experienced in connecting the meter properly in circuit as the phase rotation of the circuit must be known when making the connections. Since the meter will generally be connected in circuit along with a watt-hour meter the following check may be used on a circuit of lagging power factor. Note the fast element of the watt-hour meter and connect the shunt coil of the corresponding element to the kva.-hour meter the same as the shunt coil of the watt-hour meter. Then connect the other shunt coil of the kva.-hour meter

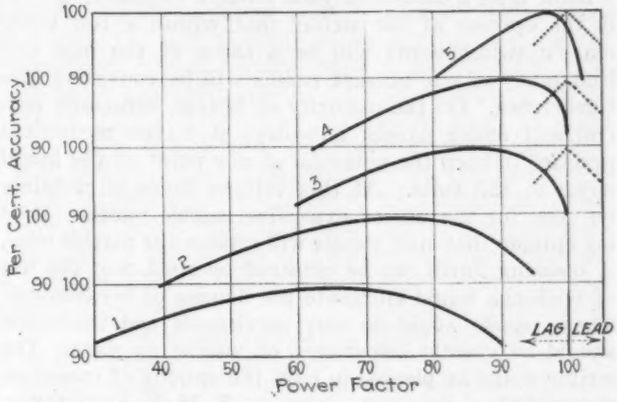


FIG. 3—ACCURACY OF METHOD AT DIFFERENT POWER FACTORS

Curve No.	Power-factor Intermediate Point	Angle of Lag of Main Circuit, Deg.	Min.	Shunt-Field Angle Deg.	Min.
1	65	49	30	109	30
2	75	41	20	101	20
3	86.6	30	00	90	00
4	90	25	50	85	50
5	98	11	20	71	20

across the two-phase wires containing the current transformers. This will place the shunt and series fields of all three elements of the meter in the same relation to each other regardless of the power factor of the circuit; that is, if the current leads the potential in one element the same condition will also exist in the other elements.

An interesting point in the method is that in no case can the meter record in excess of the apparent power value, whatever error there is being negative. This feature is considered to be an advantage as there is no chance of the error operating to the advantage of the customer.

A preliminary analysis of the power-factor conditions of the load by means of a graphic-power-factor meter should enable the selection of a power-factor range best suited to the load and determine the nature of the calibration of the meter to measure the apparent power with a good degree of accuracy.

Protecting Industrial Distribution Lines

INASMUCH as Fig. 1, page 177, of the article "Protecting Industrial Distribution Lines" in the July 24 issue shows the use of reverse-current relays as the only protection for substations, the question has been raised as to how equipment in these stations is protected. While the article dealt especially with automatic sectionalizing of the double-ring bus, it is also of interest to note that each substation switch, in addition to the reverse-power relay, is provided with straight instantaneous overload relays which give these stations protection.

Readers' Views and Comments

Steel Versus Marble Switchboards

To the Editor of the ELECTRICAL WORLD:

SIR: Is not the use of marble switchboards rather a habit than a dictate of good modern engineering? It is the opinion of the writer that within a few years marble switchboards will be a thing of the past and that many of our present panels will be converted into tombstones. On the majority of boards, especially control and meter panels, nowadays it is the recognized practice to keep the potential at any point of the board down to 125 volts. At this voltage there is certainly no need for the use of expensive marble panels. It is my opinion that steel panels will replace the marble ones. A pleasing finish can be obtained on steel, and the use of bushings would eliminate the danger of breakdowns. These panels would be very serviceable and their cost should be greatly below that of marble or slate. The writer would be pleased to have the opinion of others on the subject.

R. H. N. LOCKYER.

Trail, B. C., Canada.

Progress and the Application Engineer

To the Editor of the ELECTRICAL WORLD:

SIR: It is my belief that the industries have not yet fully realized all the advantages to be derived from the application of electrical energy to manufacturing processes. This is due, in a larger measure than is apparent, to an inherent opposition to change, and for this reason attention should be given to the encouragement and education of the application engineer. In many ways he has a hard road to travel. As the connecting link between the manufacturers of electrical equipment and other industries, he is indispensable to both. His training should include a broad knowledge of the physical sciences, and he should also be possessed of enough imagination to grasp a new idea quickly. Besides this, he should understand human nature and have the commercial instinct. If he lack these essentials, he will undoubtedly prove a detriment rather than a benefit to progress. The truth of this assertion is attested by every improper application, its failure creating unnecessary antagonism to the idea of subsequent change.

Some opposition to change is to be expected and should be welcomed as an incentive to greater effort, but upon the chronic opposer of all new ideas or the man utterly devoid of imagination no time should be wasted. Figuratively speaking, these men live, and will continue to live, in the past. It is a fact generally conceded that every one has to meet opposition, and sometimes ridicule, in bringing about changes of any kind. That many men oppose new ideas on general principles, while continuing to enjoy the fruits of ideas that were developed before they were born, will ever remain one of the peculiarities of the human race.

The industries of the world today rest upon the basic discoveries of the scientists. Following, and often helping, these great pioneers are the financial, business and professional men of all degrees of aptitude. The application engineer should be made to feel that he holds an important and honorable position among this latter group.

But to talk about these things and admit that they are true is not a particle of use unless something practical is done about it. What is needed is an educational campaign along lines that will open the minds of men and cause them to become receptive to new ideas and new ways of doing things. A concerted effort in this direction would benefit industry as a whole. This does not necessarily mean that every new idea should be accepted at face value, but the benefit of the doubt should be given to the new idea unless and until it is conclusively proved to be unsound in principle.

The progress of the world depends upon science and engineering, and the whole rests upon education.

Salem, Mass. JOHN J. BROPHY.

South American Operating Conditions

To the Editor of the ELECTRICAL WORLD:

SIR: Rather curious problems are met with in some parts of South America, where no attempt to regulate the voltage of central stations and mains is made. In Lima, for instance, during the first two or three hours of the evening, the voltage is far from the normal value (104) and oscillates from 70 to 80, dropping in some places as low as 60. Lack of official control over public service in Peru is responsible. However, consumers are beginning to act in a practical manner. The remedy was first suggested by an electrical repair shop of this city, which launched what they call here an "elevador," meaning a booster. Since then a great many auto-transformers, most of them made in Lima, are finding their way to the consumers' plants in order to bring the voltage to a proper strength.

Some progressive electric dealers, feeling convinced that matters cannot possibly improve for several years and thinking that the wide use of such boosters must imply their necessity, have sent orders to the United States for auto-transformers suitable to boost the line voltage all the way from 60 to 100 volts. As such apparatus will heavily overload existing transformers, the central stations will be forced at last to do what they should have done at first—to rearrange feeders and mains, install a few thousand kilowatts of voltage regulators and employ a load dispatcher.

Among the little incidents that have come to my notice in connection with the scramble for boosted voltage is the case of a retail electrical dealer who ordered through an agency a panel to be used in connection with the boosters for regulating the voltage. The panel came with more cost in switches, marble and fittings than it was worth. It was a clumsy five-foot, eight-switch affair, disconnected, and when it was examined it was found that there was a chance of short-circuiting the taps in case more than two blades should be closed. Besides, only four switches were required to obtain voltages from 95 to 60 in 5-volt steps. The manufacturer who sent the auto-transformers and this panel took pains to put a nameplate on every transformer but forgot to attach one to the panel! Would it not have been better for the reputation of the American manufacturer if the panel had never been sent? Such a shipment is likely to react unfavorably on all the manufacturers of the country whence it comes.

VICTOR M. ARANA,

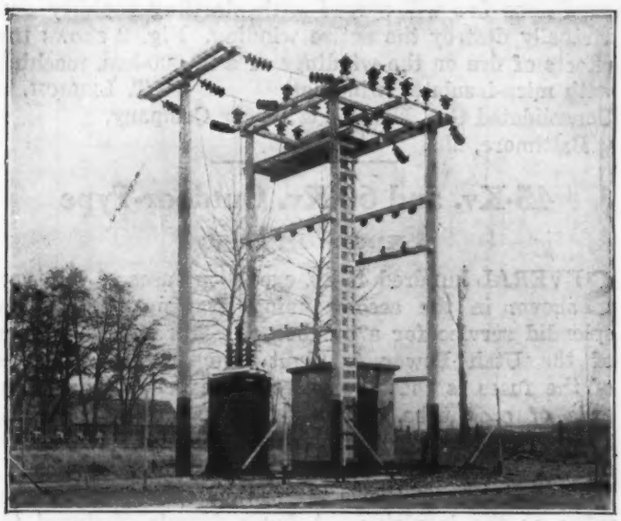
Lima, Peru. Consulting Electrical Engineer.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Galvanized Piping Used for Buses on Outdoor Substation

IN ORDER to provide a stiff construction, galvanized water pipe was used for the high-tension buses and for the leads to the transformer in the Denton City (Ore.) substation shown in the accompanying photograph. This 44,000-volt, three-phase transformer is



GALVANIZED IRON PIPE USED AS BUSES IN RURAL HIGH-TENSION SUBSTATION

used for supplying 2,300-volt energy to the surrounding farms. The structure is of wood poles and wood cross-members. All dead-end connections are made with five strain insulators in series. The air-break disconnecting switch is operated from the ground, but a wooden platform is provided just below the insulator frame for making repairs on the station. The telephone house is of corrugated iron and affords room for storing rakes, shovels and other implements used in cleaning up the premises. The iron construction prevents any danger of damage by fire.

LEWIS A. MCARTHUR,
General Manager.
Pacific Power & Light Company,
Portland, Ore.

Saving of Superheater Losses

TO SAVE the heat losses due to draining of superheaters after shutdowns of the boilers, the Arizona Copper Company, Ltd., has experimented with the use of a Sarco trap for draining the superheater of one of its boilers. This proved so effective in keeping condensation drained from the superheater that all oil-fired boilers are now equipped in this way.

The boilers used are Stirling oil-fired boilers with superheaters between the first and second pass, some of these superheaters being of the plain-tube type and others of the Foster type with corrugated cast-iron protections. Under the load conditions, which are such that each boiler is out of service for about eight hours each day, the loss of heat resulting from opening the superheater drains became quite a considerable item. The Sarco traps were placed near the floor level at the back of the boilers so there is 20 ft. to 25 ft. (6 m. to 7½ m.) of ¾-in. (18-mm.) pipe between the superheater outlet and the trap. This practice may not be possible on boilers which are operated at high capacities or on boilers which are fired up rapidly, but under conditions under which the boilers of this company are operated a very considerable saving in heat losses from boilers on stand-by is made.

NORMAN G. HARDY,
Chief Mechanical and Electrical Engineer.
Arizona Copper Company, Ltd.,
Clifton, Ariz.

Water-Spray System for Turbo-Generator Fire Protection

EFFICIENT fire protection for turbo-generators is assuming greater importance with increasing size of units. The system for combating fire which is installed on the 20,000-kva. generators of the Consolidated Gas, Electric Light & Power Company, Baltimore, as described here, employs water sprays from pipes mounted on the generator frame. Eight nozzles made of flattened 1¼ in. (3.1-cm.) pipe are set as shown in the drawing to direct sprays against the ends of the coils. Pipe sizes and nozzle openings are proportioned to give practically uniform flow from all nozzles. The dispersion of the nozzles is such that the spraying zones overlap, but as in practically every case the water will be on be-

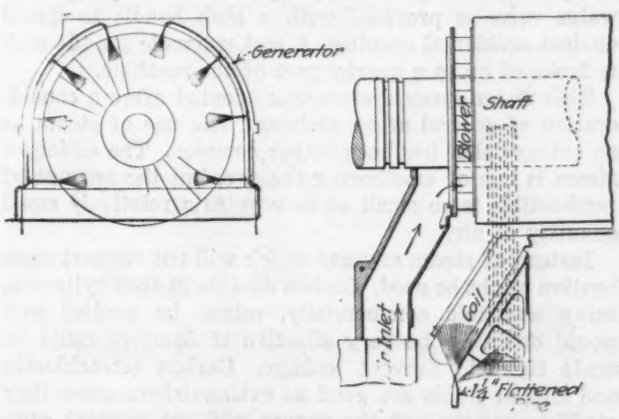


FIG. 1—WATER-SPRAY FIRE PROTECTION FOR 20,000-KVA. GENERATOR

fore the machine has ceased rotation, the rotating part can be counted upon to distribute the water over the windings. Introduction of slugs of water into the blower vanes to obtain the action of a centrifugal pump might be considered, but should be employed with caution

on account of the unbalancing effect and possible destructive action therefrom. Insulating joints prevent circulation of induced currents between the piping on the two ends of the machine.

The control arrangement consists of a lever-operated quick-opening valve in the supply pipe and a 3-in. (7.5-cm.) section of fire hose between the valve and the main to the spray headers. This hose is normally disconnected to prevent accidentally flooding the machine.

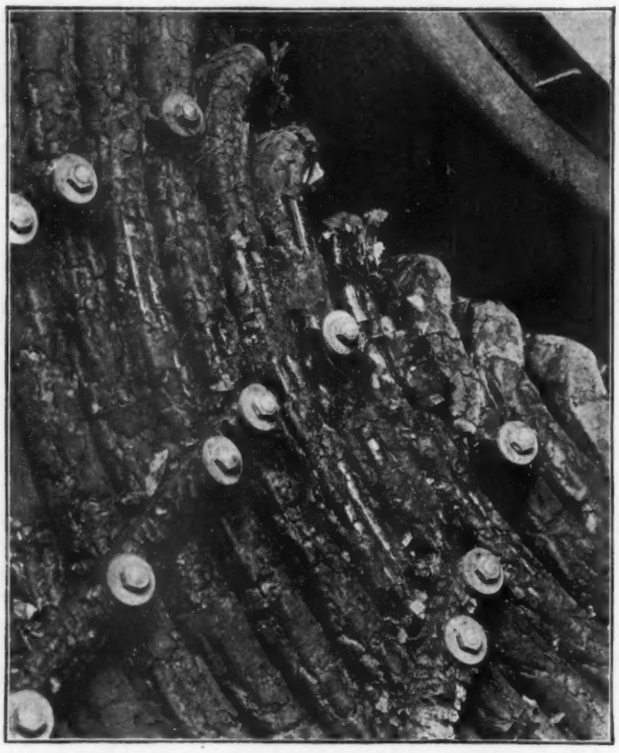


FIG. 2—MODERN BUILT-UP MICA INSULATION DESTROYED BY FIRE IN 20,000-KVA. GENERATOR

In case of fire the hose can be attached in a few seconds, as a quarter turn only is required, the hose being fitted with an Anderson patent fire coupling. The water valve is provided with a stub handle to guard against accidental opening. A socket handle for the stub is fastened on to a nearby part of the machine.

This water-spray system was adopted after a consideration of several other systems. The use of steam as an extinguisher has been rather common. The action of steam is one of smothering the fire, but the amount of combustible is so small as to require a relatively small quantity of air.

Instead of steam any gas which will not support combustion might be used. Carbon dioxide in steel cylinders, being available commercially, might be applied and would doubtless be very effective if dampers could be made tight to prevent leakage. Carbon tetrachloride and similar fluids are good as extinguishers since they readily vaporize and the vapors will not support combustion. The effect on operators and the large amounts of these fluids necessary to quench a fire are objectionable.

The chemical effect on the insulation should also be considered. Water in amounts ample to quench a fire has no chemical disadvantages, and windings which are not affected by the fire can be dried out and suffer no permanent damage.

Whatever the extinguisher used, the greatest possible benefit is that of preventing the spread of a fire and localizing the damage. Large turbo-generators must be continuously supplied with cooling air, usually at about 2 cu.ft. to 4 cu.ft. (0.056 cu.m. x 0.112 cu.m.) per minute per kva. rating, and with such large volumes of air passing through the machine a fire in the windings spreads rapidly, therefore means for suppressing the fire at the earliest possible moment should be provided. Immediately upon discovery of a fire the affected machine should be cut off, dampers closed and the fire-extinguishing agent applied. In view of the great inertia of the armature the machine will continue to rotate for some time, and hence it is important that dampers be tight to prevent the blowers on the rotor continuing to draw a new supply of air and intensifying the fire.

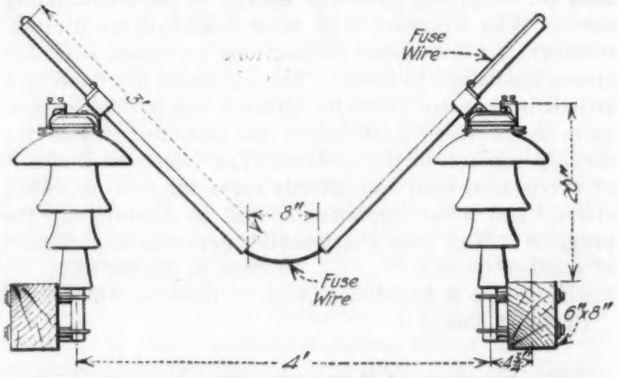
The built-up mica insulations which are largely used in modern machines appear to be almost indestructable, but recent experience has shown that under favorable conditions fire will spread with startling rapidity and virtually destroy the entire winding. Fig. 2 shows the effects of fire on the windings of a 20,000-kva. machine with mica-insulated windings.

F. T. LEILICH.
Consolidated Gas, Electric & Power Company,
Baltimore, Md.

45-Kv. and 60-Kv. Outdoor-Type Expulsion Fuses

SEVERAL hundred 45-kv. expulsion fuses of the type shown in the accompanying drawing have given splendid service for a number of years on the system of the Utah Power & Light Company. A feature of the fuses is that the gases are expelled from both ends of each tube. The fuse tubes are of 1¼-in. x 36-in. (3.2-cm. x 90-cm.) micarta tubing, treated by dipping twice into a suitable weatherproof varnish.

The photograph shows the method of supporting the tubes on the insulator. A brass ferrule, fastened to the tube by means of a setscrew, slides into a socket which is a part of the insulator cap. The fuse wire—usually of bare tinned copper or "Climax" resistance



45,000-VOLT EXPULSION FUSE FOR OUTDOOR SUBSTATIONS

wire—is clamped under a screw head on the ferrule, then is passed up along the outer surface of the tube to the end, down through the center of the tube, up through the center of the other tube and down to its fastening screw. A slightly different support is used for the 60-kv. fuses. It is customary at each substation to have an extra set of tubes ready with fuses so that no time is lost in replacing a burnt-out fuse.

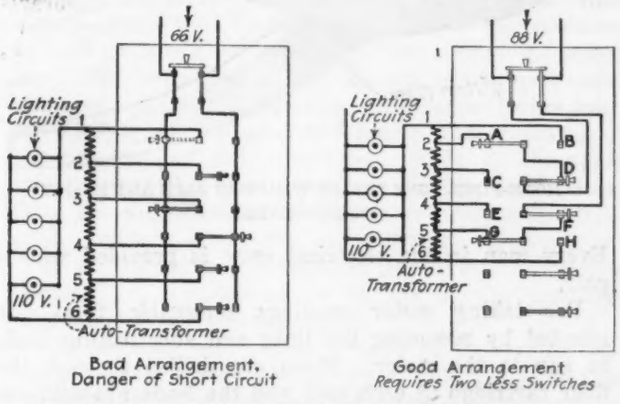
Utah Power & Light Co., PAUL P. ASHWORTH.
Salt Lake City, Utah.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Simplifying Switch Connections for Auto-Transformers

BY CHANGING the wiring connections shown on the accompanying switchboard, which is used in connection with an auto-transformer for boosting line voltage, the operation of the switches was made simpler as fewer switches are employed and the danger of short-circuit which was originally present has been eliminated. The use of this auto-transformer is necessitated by the fact that the voltage on the distribution lines in Peru, South America, sometimes drops very low so that the lamps do not burn brightly. The transformer is wound with six 10 per cent taps so that 110 volts may be obtained on the lighting circuits with a line voltage of 66 volts or over.



REWIRING OF AUTO-TRANSFORMER SWITCHBOARD WHICH ELIMINATES DANGER OF SHORT CIRCUITS

When the panel was shipped for installation it was connected with seven single-pole, double-throw switches. With such an arrangement there was always danger of short circuit by throwing any two switches in the same direction. As shown in the diagram, the dotted switch would short-circuit 30 per cent of this voltage of the auto-transformer. The change shown eliminates this danger, and only four of the switches are now used. This gives every combination of voltage possible with the auto-transformer, and the switches may be thrown in any direction without short-circuiting.

Lima, Peru, S. A. V. M. ARANA.

Avoiding Unbalanced Operation of Two-Phase Motor

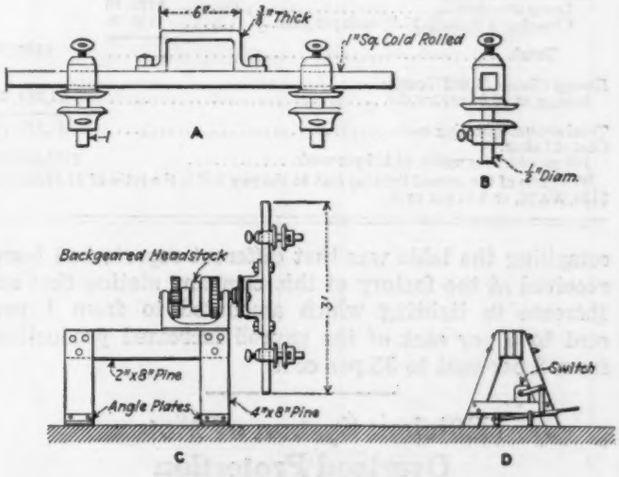
IT IS not uncommon when connecting a four-wire, two-phase motor to a three-wire, two-phase system of wiring to place the middle or common connection of the two phases on one of the outside leads instead of the middle lead of the service. When this occurs one phase of the motor receives correct voltage (say 220 volts) and the other phase receives 1.41 times correct voltage, or, if a 220-volt system, 312 volts. Further, when properly connected the two-phase voltages have an angular relation of 90 deg., but if the motor is connected as described the phase which has the high voltage is only 45 deg. away from the other phase and the result is poor torque in the motor. A motor so connected will run and carry some load and will run at correct speed, but the windings of the phase which is incorrectly connected will run hot and the motor will stall before reaching full load.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Machine for Winding Armature Coils

FOR winding armature coils the coil former and the winding machine shown here have been successfully employed in a large textile mill. The former, which is adjustable for almost any size coil, is made of a 1-in. (2.5-cm.) square bar of cold-rolled steel, 3 ft. (0.9 m.) long, mounted on a bracket of strap iron. On this 1-in. bar are placed brass or iron castings, machined to a sliding fit on the bar and provided with thumbscrews for securing them in place. On the pins (1) are two castings which are adjustable to suit the width of coil desired and secured to the pins by means of thumbscrews.

The winding machine was made very economically from an old back-geared lathe headstock mounted upon a wooden frame made up from four 4-in. x 8-in. (10-cm. x 20-cm.) legs supporting two length of 2-in. x 8-in. (5-cm. x 20-cm.) lumber with a space between them to take the mounting bolts of the headstock. These frames are attached to the floor by means of angle plates.



COIL FORMER AND WINDING MACHINE WHICH WERE MADE IN AN ELECTRICAL SHOP

The former should be driven at a speed of about 20 r.p.m. The control is by means of a foot switch mounted on the frame. In this switch an extra contact is arranged in the "off" position to provide dynamic brak-

ing by short-circuiting the armature to stop the machine immediately when the pedal is released. A 0.5-hp. shunt-wound motor has been used on this machine successfully without any starting resistance, but an over-compounded motor is preferable. L. E. WOOD.

Glasgow, Scotland.

Cost of Good Lighting Only 1.41 per Cent of Labor Cost

GOOD industrial lighting is estimated to cost only 1.41 per cent of the cost for labor in the typical case shown in the accompanying table, which was compiled by the National Mazda Lamp Company. This table is an analysis of a plant employing 100 men which is lighted by 100 200-watt tungsten lamps. The initial cost of the lighting installation was computed, using standard prices, and from this the fixed charges of interest and depreciation on the equipment were figured. The maintenance charges and energy charges added to these fixed charges gave the total operating cost. The wages for 100 men for fifty weeks were then compared with this operating cost, and it was found that the operating cost is only 1.41 per cent of the cost of labor. This typical case may even be improved on in an actual plant as the operating expenses were estimated fairly high, for instance, a 6-cent rate for energy was taken while the wage expenses were put low, only $25 per week per man. This analysis can be used as a guide for calculating conditions in any plant. The reasons for

COST OF LIGHTING TYPICAL PLANT

Initial Cost of Installation:		
100 outlets at $10 per outlet, including labor, conduit, etc.		$1,000.00
100 reflectors and holders		281.16
100 200-watt Tungsten lamps		190.90
Total installation cost		$1,472.06
Annual Operating Cost:		
Fixed Charges:		
Interest and depreciation at 10 per cent	$147.21	
Depreciation on wiring at 10 per cent	100.00	
Depreciation on reflector equipment at 10 per cent.	35.15	
Total		$282.36
Maintenance Charges:		
Lamp renewals	$190.90	
Cleaning of units @ $1.00 each per year	100.00	
Total		$290.90
Energy Charge (1,000 Hours):		
Energy at $0.06 per kw.-hr.		$1,200.00
Total annual operating cost		$1,773.26
Cost of Labor:		
100 men for fifty weeks, at $25 per week		$125,000.00

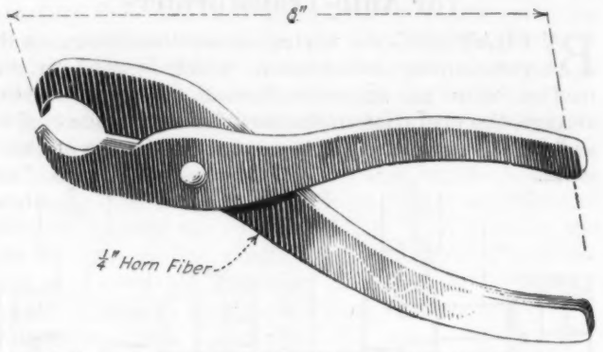
The ratio of the annual lighting cost to the pay roll is the ratio of $1,773.26 to $125,000.00, or 1.41 per cent.

compiling the table was that different reports had been received at the factory of this company stating that an increase in lighting which amounted to from 1 per cent to 5 per cent of the payroll increased production from 8 per cent to 35 per cent.

Efficient System of Motor Overload Protection

AS A RESULT of the system for protecting motors against overload in the shops of McCleary, Wallin & Crouse, Amsterdam, N. Y., there has not been a burned-out motor in five years among the 150 large group-drive motors which run six days a week in these shops. The line wires leading to these motors are fused at the compensator at twice the full-load current of the motor, renewable fuses being employed. These protect against trouble from starting, and for protection when the motor is running overload relays are provided which are set at approximately 5 per cent overload but with a liberal time limit setting based on the characteristics of the individual groups. Although the percentage overload of these relay settings is small the time limit setting takes care of the necessity of overloads for short periods. In addition to the above no-voltage releases are installed on each motor.

Fuse pullers made of ¼-in. (6.4-mm.) horn fiber are used in removing and replacing fuses. These pullers (see cut) will take any fuse from 5 amp. to 500 amp.



HORN-FIBER FUSE PULLER WHICH IS SAFE AND EASILY MANIPULATED

Every man in the electrical crew is provided with a pair.

For taking meter readings renewable fuses are adapted by removing the links and substituting leads to run to the meter. Holes are drilled through the fiber cartridge at each end, and the leads are soldered to the ferrules. This makes a simple and quick method for removing fuses and testing the current in the motor circuit. A. R. MCDONALD.

McCleary, Wallin & Crouse,
Amsterdam, N. Y.

Emergency Operation of Induction Motors at Low Speed

IN ORDER to turn down the rolls of a sugar mill it was necessary to operate them at 30 per cent speed, using the regular driving motor, as other forms of speed reduction, such as worm gearing, had proved quite unreliable.

The motor used was rated at 440 volts and 250 hp. and was of the slip-ring type. By connecting it to a 110-volt service and lifting the brushes on one phase to make the rotor operate single-phase the torque was reduced so that with the load obtained the speed was about correct for lathe operations. Push switches connected with the control contactors were placed on the side of the temporary lathe bed for starting, stopping and reversing. The resistance contactor found to give greatest starting torque under single-phase conditions was blocked shut, thereby making starting more positive. It was, however, often necessary to reverse the motor before starting to get out of low torque positions.

The starting current on the 440-volt generator panel was 25 amp. and the running current 15 amp. By this connection the 62½-kw. generator operated this motor at low speed and at the same time carried another load of 50 kw. C. G. HADLEY,

Central Palma, General Superintendent.
Cuba.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

For Better Public Relations in the Electrical Industry

FOLLOWING up its educational campaign in the interest of the electrical industry and public utilities, the Western Electric Company has issued a second series of advertisements to appear in a number of the popular magazines. Like the first series, described in detail in the March 27, 1920, issue of the ELECTRICAL WORLD, page 739, these advertisements are designed to build good-will for the several branches of the industry. Ten messages of the second series have been prepared that carry a common-sense appeal to the average citizen for fair play and better understanding of the problems of public utilities. Four of these are shown herewith. Six others are similar, but written from the viewpoint of the street railway, steam railroad, architect, contractor and telephone company.

C. G. Du Bois, president of the Western Electric Company, in commenting on the six months' publicity program just terminated, says:

"To the man who breaks ground in an untried field words of cheer from his fellows strengthen faith that the structure he is building may prove a lasting service. Our friends in the electrical industry and public utilities have given us this commendation from the very inception of our program of institutional publicity. It is now six months since this company began to publish a series of advertisements dedicated to the interest of the industry. The campaign was based on the conviction that only as the industry attains popular understanding and esteem can any part of it hope for permanent prosperity. To promote this public goodwill all parts should work together in the common cause.

"But even granted that these principles are correct, still our own small effort to further them through the printed word would accomplish little if unaided. It was vital therefore that the principles be accepted by men in all departments of electrical work as the cue to co-operative action. So when the mail began to bring expressions of hearty indorsement from all divisions of the industry in all sections of the country, we felt warranted in believing the campaign a success."

Actual results of this educational campaign cannot be measured in terms of dollars and cents, nor will the Western Electric Company be first to realize the benefits from the publicity. It is, however, building for the future, aiding others of the industry in the hope that it will share in their ultimate prosperity. The Western Electric Company is to be commended on this service it is rendering.

FOUR MESSAGES THAT WILL INSPIRE BETTER PUBLIC RELATIONS IN ALL BRANCHES OF THE ELECTRICAL INDUSTRY

Ownership of Rural Lines

EXPERIENCE in Ohio with small rural customers on 40-acre (16-hectare) to 80-acre (32-hectare) farms has led D. L. Gaskill, president of the Greenville (Ohio) Electric Company, to advise other Ohio central-station executives to insist that farmers build, own and maintain all rural electric lines. The Greenville company requires farmers to build all their lines in accordance with the company's specifications, and all transformers must be purchased from the company in order that they may be kept uniform and interchangeable. All other line material is purchased from jobbers or dealers.

Under this arrangement the central station is not responsible for taking on additional consumers, nor is it liable for the renewal of the line or for damages due to accidents. However, the plan brought up some legal and practical questions in connection with supplying service to additional customers. These problems have been solved by allowing other consumers to connect to the line under certain specified conditions, some of which are as follows:

Extensions to the end of the line will be allowed at the expense of the party desiring service, but without any refund to the original builders.

Farmers along the line who are not original consumers may get service by paying for the cost of the service tap to their premises and paying their proportionate share of the cost of the line. This latter payment shall be refunded to the original builders of the line. For instance, if ten farmers originally built the line, the first additional farmer that wanted service would refund to the others one-eleventh of the original cost, the next customer would refund one-twelfth of the total cost, and so on.

Farmers off the line who require extensions at right angles to the main line may obtain service by paying the entire cost of the extension and paying to the original consumers a proportionate share of the expense of the main line.

Utility Sells Common Stock Above Par

IN THREE days employees sold at $112.50 per share more than $900,000 par value of the stock of the Commonwealth Edison Company of Chicago. To increase the number of its stockholders the company set aside 5,000 shares of its stock, but the demand was so great that at the end of the third day the sale was terminated.

No dividend is guaranteed on the stock, but it has been paying 8 per cent and its market price at the time of the sale was between $111 and $112. The company's price of $112.50 a share was based on an extended payment plan of $5 down and $5 per month. Purchasers were credited with the dividends and charged 6 per cent on the deferred payments.

Thirty-five teams of employees, each consisting of ten men and a captain, acted as stock salesmen. A captain was chosen from among the employees in each of the thirty-five wards of the city, and each captain was allowed to pick a team of ten from among the company's employees residing in his ward. Fifteen team prizes, ranging from $5 to $75 and totaling $600, were awarded to the team captains, who were also given a commission of 10 cents on each share of stock sold by their team. Teams were rated on a point basis, two points for each share of stock sold and one point for each stockholder. The team salesmen working under each captain were given $1 for each share of stock sold. The sale was started at 6 o'clock on a Monday morning, that hour being chosen because all soliciting was to be done outside of business hours, and at noon on Wednesday the teams were instructed to take no more orders.

So many customers claimed that they had been promised shares by employees that the original allotmen of 5,000 shares had to be increased to 9,103 shares, which were sold to 2,805 new stockholders and over 700 old stockholders.

Wilmington Company Discontinues Merchandising

IN 1919 the Wilmington & Philadelphia Traction Company of Wilmington, Del., discontinued its electrical merchandising department. The company had experienced considerable difficulty in maintaining an adequate force for the department. Service to customers in furnishing repairs and renewals to appliances could not be kept up to the desired standard and the department was operating at a loss.

As the company's office is situated in the main shopping district of Wilmington it is an excellent location for an electric shop. Negotiations were conducted with an outside dealer and an arrangement was made whereby space in the company's office was leased by the Wilmington Electric Appliance Company. The appliance company took over the merchandising business and handles all repairs and maintenance of appliances. This plan has been in operation for a little more than a year and has been found mutually profitable by both the parties.

Keeping the Consumer Informed

PARTICULAR attention is paid by the Southern California Edison Company to ways and means of maintaining relations with customers on the Golden Rule basis. Courtesy and diplomacy in dealing with the customer have been developed to a fine art, largely through the methods advocated by S. M. Kennedy, vice-president and general agent, who ably presented his viewpoints on these matters in a paper entitled "Service" read before the Pasadena Convention of the N.E.L.A. last May and the article which appeared in the ELECTRICAL WORLD for July 17 under the title "I Thank You."

The accompanying illustration furnishes an example of how the Southern California Edison Company is securing the assistance of its customers in the present power shortage and at the same time explaining the surcharge granted by the commision.

NOTICE

Owing to the shortage of hydro-electric power and the necessity for generating a large amount of power by steam, you can directly help us as well as help yourself by using your electric service on the most economical basis possible. It is our belief that if the average consumer will apply himself to this problem, the emergency surcharge of 27 per cent granted by the Railroad Commission will enable the company to pay the increased cost of developing power without being a direct burden to the same extent on the individual consumer.

Your co-operation in this matter will be greatly appreciated.

SOUTHERN CALIFORNIA EDISON COMPANY

SLIP DISTRIBUTED TO CUSTOMERS THROUGH DISTRICT OFFICES

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Safety-First Testing of Small Transformers.—A. HECKMAN.—In the routine testing of such equipment as shunt transformers at the manufacturing plants, where speed is essential in order not to interfere with production, great care must be exercised in the arrangement of testing devices for the protection of the tester. Features safeguarding the test man are given in detail. —*Electric Journal*, August, 1920.

Electrical Device for Checking the Oil Temperature of Medium-Sized Turbo-Generators.—GEORGE J. DUCKETT. —Description of a device designed to give attention automatically to the oiling systems in steam-turbine units.—London *Electrician*, July 16, 1920.

Lamps and Lighting

The Lighting of Textile Mills.—A. L. POWELL.—General rules for the lighting system of a textile mill are given as follows: (1) There must be sufficient light of the proper quality on the work. (2) Glare due to brilliant light sources or reflected from polished surfaces must be avoided. (3) Diffusion and proper direction of light are necessary to eliminate sharp shadows. Moderate light on side walls not only helps in this connection but also makes the room more cheerful. Too much light on the walls is tiring. (4) Besides the light on the work, a moderate intensity should be provided on intermediate sections so as to eliminate dark spaces. (5) Any system installed in the mill should be simple in arrangement, reliable in operation and as low in operating cost as is possible. In no case, however, should good lighting be sacrificed for such a saving, because in the long run this would be found to be poor economy. —*Bulletin L.D. 110, Edison Lamp Works*, May, 1920.

The Lighting of Office Buildings and Drafting Rooms. —A. L. POWELL.—A discussion of the elements which enter into the lighting of offices and drafting rooms, including the practical spacing of outlets and choice of lighting systems to function for the particular class of work being done in the office.—*Bulletin L.D. 108, Edison Lamp Works*, May 20, 1920.

Generation, Transformation and Distribution

Hydro-Electric Power Works at the Great Lake, Tasmania.—An interesting scheme of speed control of Pelton waterwheels is described for which it is claimed the advantages of both needle and deflector regulation are secured. It is said to be arranged so that the first action of the governor on load being reduced is to deflect the jets away from the wheel by means of a simple deflector. This same movement releases the needles and allows them to travel slowly forward, the speed being adjusted very simply so that the time required for the full stroke is any desired figure.—London *Engineer*, July 9, 1920.

Pelton Wheel Reconstruction.—PERCY PITMAN.—Structural changes are described in Pelton waterwheels, first to replace defective and broken buckets which were becoming a source of considerable danger, and second to economize water by fitting on buckets of a more modern and efficient type. It is reported that the efficiency of the wheels in question was improved about 5 per cent by these changes.—London *Engineering*, June 25, 1920.

The Selection of Oil Circuit Breakers.—W. A. COATES.—The writer discusses the rating of oil circuit breakers with reference to breaking capacity as defined by the British Engineering Standards Association. He also points out that there would be great advantage in having graphical methods of determining short-circuit current values in networks and shows a chart devised by himself which he says should be useful in this connection.—London *Electrician*, July 2, 1920.

Traction

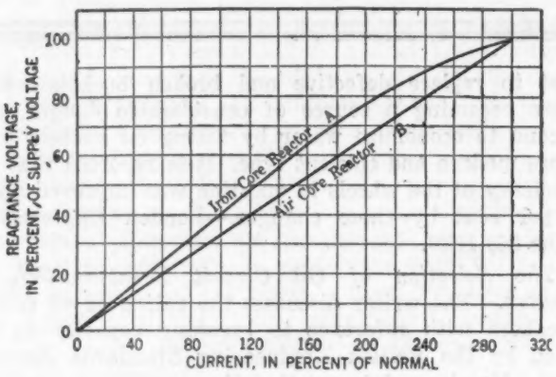
Graphical Method for Computing Voltage Drops in Distribution Networks.—A. SCHWAIGER.—The author's method appears to be built on the same principle as the Frick method for computing current distribution in networks, although the entire solution is worked out graphically, without any numerical computations. A number of simple cases are given to illustrate the operation of the graphical method, and the article also shows how the method may be applied to more complicated networks, by proceeding step-wise, as follows: (1) All knot points are considered as feeding points and the currents to be supplied at the knot points are determined. (2) It is then assumed that the net is loaded only with these hypothetical feeder currents and supplied at the actual feeding points. (3) These two solutions are superposed, the fictitious knot point currents canceling and the actual current distribution coming out as a result. (4) Since the current distribution now is known, the drop to any point may be easily computed. The virtually new feature is the graphical method of solving part two of the problem.—*Elektrotechnische Zeitschrift*, March 18, 1920.

Installations, Systems and Appliances

The Electrical Sterilization of Milk.—An account of researches conducted by Prof. J. Martin Beattie and F. C. Lewis of Liverpool University, England. It is said that the electrical method used, whatever the lethal effect may be, is a much more efficient method of ridding milk of bacteria than are the processes in common use at present.—London *Electrical Times*, July 15, 1920.

Reactors for Electric Furnace Circuits.—HARRY A. WINNE.—Various methods of introducing reactance into furnace circuits are covered in this article. It is said that the internal reactance of transformers can be increased to a maximum of about 20 per cent without excessively increasing the cost or decreasing the efficiency of the transformer. Another arrangement is to increase the spacing between transformer leads, thus increasing their inductance. When external reactors

become necessary recourse may be had to either the iron-core or air-core reactor. Air-core reactors are well known from their use in power plants. Regarding iron-core reactors, it is said that these are arranged with an air gap in the magnetic circuit. Care must be exercised to insure that the iron core will not be



CHARACTERISTICS OF REACTORS

saturated at the maximum value of current which can be forced through the circuit. If this is not done, the reactor will not be so effective for heavy overload current as for light-load currents. The working range of current, therefore, should fall below the knee of the saturation curve.—*Journal A. I. E. E.*, June, 1920.

Automatic Control of Reversing Rolling-Mill Equipment.—E. S. LAMMERS, JR.—Direct-current motors are universally applied to large reversing mills, owing to the variable speed characteristics, and to its ease of control and rapid manipulation brought about by the Ilgner system. The advantages of this system are as follows: (1) It permits the permanent connection of all heavy-current circuits. (2) The entire control of the motor is effected in relatively small-current field circuits. (3) The motor automatically adapts itself to regeneration on deceleration without further complicity. (4) By regeneration the power used in acceleration is to a large degree returned to the system in deceleration and no additional power from the line is required to retard the motion of the motor. (5) All peak loads are eliminated from the power house by means whereby the stored energy of a flywheel on the motor-generator set is released during the periods of those peaks absorbing same.—Paper rear before A. I. and S. E. E., May, 1920.

Electrophysics and Magnetism

Copper a Delicate Material.—N. B. PILLING.—A discussion of the effect on the physical proporties of copper of occluded gases.—*Electric Journal*, August, 1920.

Magnetic Properties of Iron Alloys.—The series of articles on the relation of magnetic properties and electric conductivity of iron to its percentage of carbon, aluminum, silicon and manganese, etc., published by Gumlish and Goerens in the *Elektrotechnische Zeitschrift*, June 26 to July 24, and referred to in these columns on Feb. 14, is reprinted almost in full in the *Revue Générale d'Electricité* of May 1, 1920.

Reflecting Power of Monel Metal Stellite and Zinc.—W. W. COBLENTZ.—Data are given on the reflecting power of these metals in the visible spectrum and to 4μ in the infra-red spectrum. It was found that in the infra-red spectrum the reflectivity of monel metal is practically the same as that of nickel, while in the visible spectrum the reflectivity is slightly lower than that of nickel. A new determination of the reflecting power of a sample of stellite was 1 per cent lower than values previously given in the visible spectrum. Results show that zinc is unique in having a deep depression in the reflectivity curve at 1μ followed by an unusually high reflectivity beyond 2μ.—*Scientific Paper No. 379, U. S. Bureau of Standards*, June 10, 1920.

Units, Measurements and Instruments

Bridge Methods for Alternating-Current Measurements.—D. I. CONE.—Seventeen different bridge combinations are shown for the measurement of the characteristics of circuits containing inductance and capacity.—*Journal A. I. E. E.*, July, 1920.

Telegraphy, Telephony and Signals

Multiplex Telephony and Telegraphy Over Open-Circuit Bare Wires Laid in the Earth or Sea.—MAJ.-GEN. GEORGE O. SQUIER.—Since it had already been possible to communicate by radio between one submarine and another, it was considered that connecting two such stations by a submerged copper wire would facilitate the propagation of the electro-magnetic waves between the stations. Following this telephone and telegraph communications were established across the Potomac River over a distance of about three-quarters of a mile (1.2 km.) by the use of No. 12 phosphor-bronze wire laid in the water to connect the stations. The transmitter consisted of an electron tube oscillator which delivered a current of about 270 milliamperes at a frequency of about 300,000 cycles. At the receiving end of the end an electron tube and a six-stage amplifier were used without any ground connections. With this equipment tuning was obtained at both ends of the line and telegraphic and telephonic transmission secured over the bare wires immersed in fresh water. Telegraph and telephone communication has also been established between two stations at Little Silver, N. J., using bare No. 16 copper wire buried in the earth to a depth of about 8 in. (20 cm.) to connect stations. The distance between the stations was three-quarters of a mile, and frequencies as high as 1,000,000 cycles were used. Similar communication has also been carried on over bare wires 1¾ miles (2.8 km.) long and laid on the surface of moist earth. It is said that the most promising hope of improving line construction for ocean cables is believed to be to abandon the present methods of design and construction and to start with the simple case of bare wires in water, giving high-frequency currents, and study the necessary changes to produce optimum transmission.—*Journal Franklin Institute*, June, 1920.

The Carbon Transmitter.—H. J. GREGORY.—A simple theory is offered by the writer to show that the transmitter is similar in its mode of operation to an alternator. The output characteristic and internal impedance are shown to be quite analogous to these characteristics in alternators.—*Post Office Electrical Engineers' Journal*, July, 1920.

Miscellaneous

Organization of the Electrical Industry.—C. H. WORDINGHAM.—The author points out the desirability that engineers of all branches of the profession shall have some body which will represent their interests when questions of both external and internal policy have to be decided. He outlines the possible organization of such a senate.—London *Electrician*, April 30, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

MEASURING INSTRUMENTS FOR CONTROLLING INDUSTRIAL PROCESSES.

One of the companies manufacturing precision instruments reports the development of an automatic potentiometer and an automatic Wheatstone bridge, both used for recording or controlling processes or a combination of the two. These automatic equipments are supplied for the control of chemical and electrochemical processes, and some installations are in actual use. For chemical and electrochemical work the automatic Wheatstone bridge can be operated on a commercial 60-cycle alternating-current circuit, and a special alternating-current galvanometer has been especially developed for this equipment. Two of the important applications of the alternating-current Wheatstone bridge equipment are the recording of surface condenser leakage in power-plant operation and the controlling of the finish point during the evaporation process in plants making condensed milk. The potentiometer equipment is also used for accurately recording and even controlling the acidity and alkalinity of solutions through the measure of the potential between two electrodes immersed in the liquid.—*A. I. E. E. Committee on Instruments and Measurements.*

PORCELAIN, NON-POROUS.

Porcelain can be and is produced today that is in an engineering sense absolutely non-porous. This statement is made after a great deal of careful research and on the strength of many porosity tests both by the impregnation method and by the method used in ceramic analysis with a psychometer and a sample crushed to a 100-mesh fineness. The impregnation test has been carried in our laboratories to very high pressures and is so penetrating that under microscopic examination of the penetration of the colorant material it has been observed in the cleavage cracks of microscopic quartz crystals.—*W. D. A. Peaslee, Huntington, W. Va. (A. I. E. E. Journal, 1920, page 445.)*

STORAGE BATTERY, TESTING BY CADMIUM ELECTRODE.

The well-known method of testing the potentials of the lead plates with respect to the electrolyte with a piece of metallic cadmium often leads to contradictory results. An investigation has been made to determine the accuracy of the cadmium electrode and of the errors to which it is subjected. The most important error found was due to polarization of the electrode, but this error can be easily avoided if the electrode is used to measure the potential of the negative plate only and the potential of the positive plate is calculated from the known cell voltage.—*H. D. Holler and J. M. Braham, Bureau of Standards, Washington, D. C.*

VOLTMETER, ELECTROSTATIC.

In the ordinary types of electrostatic voltmeter the deflection produced is not proportional to the voltage for any considerable range. Great difficulty is experienced in properly shielding the charged parts of the voltmeter from charges on the surrounding walls. A null type of electrostatic voltmeter has therefore been developed which seems to be free from these disadvantages. The compensating force is applied somewhat as in an ordinary type of ammeter, the voltage being determined from the amount of current necessary to prevent deflection of the needle. The part receiving the charge at high voltage is either of the ordinary quadrant or of the attracted ball type. These parts are connected with the part to which the compensating force is applied through a rigid stem carrying a mirror. The compensating coils may be constructed in a variety of forms either singly or in pairs, or else magnetic cores may be used which move axially along a single coil. The zero position of the moving part is maintained either by fiber suspension or by a coiled spring. The damping may be either electromagnetic or by oil viscosity. By means of these and other improvements the range of operation has been more than doubled and the sensibility increased almost indefinitely.—*J. C. Schrader, East Pittsburgh, Pa.*

WAVES, ELECTROMAGNETIC, OVER BARE WIRES.

The Signal Corps has carried out certain investigations into the phenomena connected with the transmission of high-frequency electromagnetic waves over bare wires in earth and in water. Telephone and telegraph communication has been established between Fort Washington, Md., and Fort Hunt, Va., across the Potomac River, below the city of Washington, over a distance of about three-quarters of a mile, (12 km.), by the use of a bare No. 12 phosphor bronze wire laid in the water to connect the stations. The transmitter consisted of an electron tube oscillator which delivered a current of about 270 milliamperes to the line at a frequency of about 600,000 cycles. At the receiving end of the line an electron tube and a six-stage amplifier were used without any ground connection. With this arrangement good tuning was obtained at both ends of the line, and telegraphic and telephonic transmission were secured over the bare wires immersed in fresh water. Satisfactory communication has also been established, using a bare No. 16 copper wire buried in the earth to about a depth of 8 in. (20 cm.) and also laid on the surface of moist earth. Frequencies as high as 1,000,000 cycles were used.—*G. O. Squier, War Department, Washington, D. C.*

X-RAY BULBS, VACUUM REGULATOR FOR.

In X-ray bulbs and other systems in which the gas pressure is to be maintained at some value between 10^{-5} mm. and 10^{-6} mm. of mercury and in which the influx or clean-up of gases is not too great a modification of the hot cathode tube may be used to maintain any desired pressure between the limits mentioned. The tube as built is similar to the ordinary high-voltage rectifier, a somewhat simpler structure being possible on account of the absence of high voltages. The desired gas pressure is obtained by a regulation of the current through the tube. In this vacuum regulator, in any state, the logarithm of the gas pressure is a linear function of the energy supplied to the anode. Varying the energy from 0 watt to 250 watts gives a pressure variation from 10^{-5} mm. to 10^{-3} mm. The energy is supplied from a 500-volt direct-current circuit connected across the electrodes of the tube and is controlled by varying the heating current in the cathode filament. A wattmeter connected in the main circuit may be calibrated to read pressure directly.—*H. M. Ryder, East Pittsburgh, Pa.*

Suggestions for Research

MAGNET, A.-C., HEATING OF LAMINATIONS.

Designers of alternating-current solenoid magnets would like to know more about the insulation of plunger laminations, to avoid heating at and near the air gap. The flux tends to come through the laminations at the sides, causing eddy-current heating, which is much higher than is to be expected in an ordinary core. To avoid the heating we used insulation of $\frac{1}{16}$ in to $\frac{1}{32}$ in., (1.6 mm. to 0.8 mm.) thick about every $\frac{1}{4}$ in. (6.35 mm.) in the laminated plunger. This reduces the heating considerably, but it is still a troublesome problem. I realize that by building the plunger out of wire we could get rid of this heating, but wire plungers are rather difficult to manufacture.—*A. M. Holcomb, Cleveland, Ohio.*

RADIO, RESONANCE WAVE COIL.

The development of types of resonance wave coils, both open at one end and open at both ends, for general radio work offers an interesting field for investigation. This involves the study of the electron tube as a potentially operated device. The application of such coils properly designed for specific purposes may lead to the practical solution of a number of radio problems such as directional effects and wave-coil antennas of very small dimensions.—*G. O. Squier, War Department, Washington.*

REACTIVE COILS WITH IRON.

Reactive coils used for the protection of large generators and feeders against short circuits are made without iron cores, in order to be instantly effective no matter at which point of a cycle a short circuit occurs. Residual magnetism in a large closed iron core might cause an excessive rush of current at the first instant of a disturbance. It would be of interest to try the effect of an iron core of small cross-section, both open and closed, on sudden short circuits. It is possible that a moderate amount of very high-grade iron might not impair the effectiveness of the coil and yet permit appreciable reduction in size.

REACTIVE POWER, DISPATCHING OF.

With large interconnected power stations it becomes highly desirable for the chief load dispatcher to apportion to each station not only its share of load in kilowatts but the amount of reactive kilovolt-amperes as well. Otherwise large quantities of idle power would unnecessarily circulate in the system, causing disturbances and losses. There seems to be no standard practice in existence as to the proper method of dispatching of reactive power, and a careful investigation of the problem is desired with the view of arriving at certain general conclusions by which load dispatchers in large systems may be guided.—*Editorial Suggestion.*

SELF-STARTERS FOR AIRPLANE ENGINES.

With the increase in the size and power of engines the need of mechanical starters is becoming more and more clearly defined. The self-starter is now a recognized feature of seaplane equipment and is attracting increasing interest as a feature for land machines. Both electric and compressed air forms have been developed to a certain degree of efficiency. There is room for improvement as regards (1) size, (2) weight, (3) reliability.—*W. F. Durand, Scientific Attaché, American Embassy, Paris.*

WELDING MACHINES, RATING OF.

A considerable number of competitive direct-current welding machines are on the market, and the time has arrived for establishing a rational and uniform basis for their rating, a basis truly indicative of the work which a machine is capable of performing day after day. The rating on the basis of a continuous-current output is too severe, while the rating based on from thirty to sixty minutes' welding service is inadequate. The rating founded on kilowatts in the arc is unsatisfactory, because with the same current the required arc voltage depends upon the nature of the electrodes (metal or carbon). Objections have also been raised against rating in heat units available for welding purposes and against a rating expressed in the number of pounds of metal deposited per hour. All these points are discussed by R. E. Kinkead in his paper before the annual A. I. E. E. convention of 1920, and a strong sentiment is expressed in favor of an equitable and uniform method of rating of electric welding machines. A careful experimental study of the performance of various welding machines under comparable conditions is needed before the elements of such an equitable and just rating can be agreed upon.—*Editorial Suggestion.*

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

SALES of electrical material in almost every district are reported as considerably higher than usual at this period of the year. Exceptions are noted, however, in the Puget Sound and Intermountain sections, where the midsummer slump is more strongly felt.

INCREASING tightness of money is reported, and collections are slowing up in all sections. Good crops are in evidence, and when they are harvested the credit situation will improve.

CONSTRUCTION is in good shape only in the South, searcity of material and high prices still operating to retard it elsewhere. Commercial building, however, is going forward in the East.

MANUFACTURERS of household appliances are preparing for a heavy foreign trade and are looking for new devices to stimulate still further the domestic market, now thought to be at its peak.

DESPITE reports to the contrary, there still seems to be a sufficient supply of raw material for lighting-fixture glassware. Shipments of ordinary commercial glassware to fill large orders can be made in three to six weeks.

UNEVEN conditions exist in the industrial reflector market, but producers generally are optimistic. Stocks of finished reflectors are in poor shape.

A MOVEMENT in the direction of standardizing plugs and receptacles is under way, promoted by the regulations and standards committee of the Association of Municipal Electrical Utilities of Ontario.

ADDITIONAL hearings on the coal situation by the Senate committee on reconstruction and production have been held at Baltimore and Philadelphia, and one will be held in Boston on Aug. 30.

THE COAL supply of the New York utilities shows a slight improvement over last week.

CONFERENCES between the Federal Power Commission and members of the water-power committee of the N. E. L. A. and others were held at Washington this week. S. Z. Mitchell expressed the opinion that the law must be amended or else liberally interpreted to attract capital.

ELECTRICAL merchandise will be handled by a chain of stores to be opened by the Winchester Repeating Arms Company in a number of states.

THE THIRTEENTH annual convention of the Northwest Electric Light and Power Association will be held at Spokane, Wash., Sept. 8 to 11.

AT A MEETING of the International Bureau of Weights and Measures to be held at Paris in September the enlargement of the functions of the bureau to include other standards and values will come up for consideration.

TACOMA (Wash.) city officials persist in their policy of selling electric ranges direct to consumers, despite protests from local dealers.

SPECIFICATIONS for rural-line construction are being prepared by the Railroad Commission of Wisconsin.

DISSEMINATION of information concerning public utilities as undertaken by the state committee organized for that purpose will receive especial attention at the meeting of the Nebraska Section, N. E. L. A., at Omaha on Sept. 8 and 9.

A DECISION of the Massachusetts Department of Public Utilities refused to put upon the Boston Edison company the burden of extending a three-phase feeder more than half a mile to serve the electric elevator of a single residential customer.

COMMERCIAL and press messages to European and South American countries are now being transmitted by the navy radio service under authority of an act passed at the last session of Congress.

A PARTY of European electrical engineers representing France, Belgium and Italy is now traveling in the United States inspecting the operation of power plants with a view to giving orders for equipment to be used in reconstruction in their respective nations.

SOUTH DAKOTA voters will probably be asked to vote on the Mobridge hydro-electric project next spring.

JOINT sessions on matters of general interest and separate business sessions will be held by the Rocky Mountain Section, N. E. L. A., and the Colorado Electric Light, Power and Railway Association at their Glenwood Springs convention, Sept. 13-15.

ON AUG. 15 the new Kerckhoff project of the San Joaquin Light & Power Company of Fresno, Cal., was put into operation at Auberry, Cal., before 2,500 enthusiastic guests, thus ending a three years' dearth of power in that region.

OBJECTIONS made by the N. E. L. A. and others interested in the National Electrical Safety Code will be incorporated by the Bureau of Standards in the new edition of the rules, together with the bureau's reasons for not altering the rules at this time.

HOGGED fuel is to be used to save coal at the plant of the Albuquerque (N. M.) Gas & Electric Company.

STORAGE-BATTERY buses are being successfully used by the Tramway Company of Rio de Janeiro, Brazil, to assist in passenger transportation.

REGULATIONS for the Federal Power Commission are being whipped into final shape with the assistance of a committee of the N. E. L. A. and others interested in water-power development.

THE ORDER giving coal mines the first call on open-top cars has been extended by the Interstate Commerce Commission for an additional thirty days.

EMPLOYERS are being warned by the Industrial Commission of New York State to comply with the provisions of the workmen's compensation law.

POWER requirements for the new battle cruisers which are to be electrically operated are comparable to those of the largest central stations, their generators being rated at 160,000 kva.

A GREAT increase in the coal costs of utility companies will be caused by the 40 per cent raise in Eastern freight rates which goes into effect next week.

FOR THE first seven months of 1920 the energy output of the Narragansett Electric Lighting Company, Providence, R. I., was at an annual rate nearly three times the output of 1916. High prices and coal scarcity are causing industrial concerns throughout its territory to turn to central-station service.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Asks Amendment of Water-Power Act to Attract Capital

DECLARING that under strict construction of the water-power act it will be found virtually impossible to finance any large undertaking, S. Z. Mitchell, president of the Electric Bond & Share Company, told the Federal Power Commission at a hearing given prior to complete organization that either the commission must interpret the law liberally or it must be amended.

"In projects which require five years or more to build," Mr. Mitchell said, "the companies must be allowed to amortize earnings from the day on which they receive their capital from investors. No company could afford to pay interest on the millions involved in construction unless it were allowed to assess rates when the operation was completed which would make up the deficit incurred during the construction period. The law makes no provision for this form of amortization."

Secretary of the Interior John Barton Payne declared that he did not like the tendency of the water-power interests to lean upon the commission for support.

"The water-power companies must stand upon their own bottoms," he said. "They are not the children of the commission. Our function is to give all possible leeway to private enterprise and not to block it. The companies must work out their own financial problems in the assurance that the government will treat them fairly."

New Outlet for Electrical Merchandise Through Chain Stores

ARRANGEMENTS have been made by the Winchester Repeating Arms Company of New Haven, Conn., to open a chain of retail stores in all of the principal cities. These stores will handle electrical merchandise in addition to the Winchester and general hardware lines that are carried in the four stores at present operated. The stores now in operation are at Providence, R. I.; Boston, Mass.; New Haven, Conn., and Troy, N. Y.

Within the next two months stores will be opened at Springfield, Mass.; Pawtucket, R. I.; Summer Street, Boston, Mass., and Lawrence, Mass. Definite plans have also been made for opening stores at Fall River, Mass.; Norfolk, Va.; Jacksonville, Fla.; Syracuse, N. Y., and Worcester, Mass.

It is not the intention, said J. L. Ackerson, vice-president, to carry a complete line of electrical goods, but rather to round out the stock of household necessities that the retail stores now carry. Vacuum cleaners, washing machines, flatirons, heating appliances, flashlamps, etc., will be placed in stock. Ornamental goods such as floor lamps will not be carried, according to present plans

Regulations and Rules of Federal Power Commission

FOLLOWING conferences between representatives of the Federal Power Commission, the water-power committee of the National Electric Light Association and other interests, the rules and regulations for the administration of the water-power act are being whipped into final shape. Most of the regulations were approved in the exact language in which they were drawn. As the conference was interested more in general principles than in exact language, many of the controverted regulations are being redrafted with a committee of the outside interests sitting in at the meetings.

The following members of the N. E. L. A. water-power committee were present: Franklin T. Griffith, chairman; W. A Brackenridge, vice-chairman; Morris Cohn, Harris B. Freeman, Thomas W. Martin and G. W. Talbot. Chief Engineer Thurlow of the Alabama Power Company is associated with the committee. Among others who attended or were represented at the conferences were Secretary Baker, Secretary Meredith and Secretary Payne; Secretary Merrill of the commission and his assistant, Mr. Randall; the Judge Advocate General, Major General Enoch H. Crowder and Major L. W. Call of the Judge Advocate General's department, who is acting as counsel for the commission.

As already announced, the offices of the Power Commission will be established in the Interior Department building in Washington.

As originally drafted, Section M of Regulation 1 read as follows:

M. "Construction of project works" means the actual construction of dams, water conduits, power houses, transmission lines or some permanent structure necessary to the operation of a complete project, and does not include surveys or the building of roads and trails, or the clearing of reservoir sites or other lands to be occupied, or the performance of any work preliminary to the actual construction of permanent project works.

The following change was suggested and probably will be adopted:

We believe "construction of project works" should include the building of roads and trails as it is frequently necessary to build a substantial and lengthy road to a power site before any actual work can be done thereat. The obligation of constructing a road is imposed upon a power development, and we believe the cost so incurred should be included in the cost of the project and that the work of building such a road should be considered as a part of the construction of the project works. When roads are destroyed by project works and the developer is required to substitute another in conformity with state laws or the terms of the charter, the cost of building the substituted roads should be included in the cost of the project.

After long discussion, no agreement could be reached as to Section N of Regulation 1, Section N reads as follows:

N. "Power capacity" of a project means the continued product of (1) the factor 0.08; (2) the average effective head in feet, and (3) the stream flow in second-feet estimated to be economically available.

It was contended that in determining "power capacity" the minimum flow of streams should be the third factor.

Section 6 of Regulation 3, as drafted, requires a statement as to the proposed plan of financing the development for which a preliminary permit has been asked. It was suggested that this should be changed so as to read "Such data as the applicant desires to supply as to his ability to finance the project." No conclusion was reached in that connection.

Section 5 of Regulation 4 and Section 7 of the same regulation called for a large amount of detailed information on the application for major project licenses. It was decided that only general information will be required on the application. The commission is to call for such special information as may be required. The full detail then may be supplied when the project is

OFFICIAL SEAL OF THE FEDERAL POWER COMMISSION

complete. Practically the same conclusion was reached in regard to Section 9 of Regulation 4.

Section 12 of Regulation 4, as drafted, reads as follows:

12. A statement, in duplicate, of the action taken by the applicant in order to comply with the laws of the state or states within which the project is located with respect to bed or banks and that the applicant has fully complied with such laws.

The following substitute was suggested:

A statement in duplicate showing that the applicant has complied with the laws of the state or states within which the project is located with respect to bed and banks and with respect to the right to engage in the business of developing, transmitting and distributing power and in any other business necessary to effect the purposes of a license under this act.

Executive Secretary Merrill did not approve the language of the substitute, but he does agree with the principle involved.

Considerable discussion was had on Section 14 of Regulation 4. It reads as follows:

14. A detailed statement, in duplicate, of the financial arrangements that have been made for developing the project and of financial plans for future execution.

It was claimed that it would be difficult and in many cases impossible to secure the consent of bankers to a full compliance with the section prior to the issuance of a final license. The discussion went into the relation of state laws and the lack of standardization, as well as the inability of the commission with its present personnel to keep the records necessary.

Section B of Regulation 6 was drafted in the following language:

B. Priority established by preliminary permit may be lost if additional data required by the commission are not filed within the time prescribed, if there is failure to fulfill the requirements of the permit, if the permit is canceled, if there is failure to present satisfactory evidence of ability to carry out the plans proposed, if the proposed conditions of the license are not accepted within the time fixed by the commission, or if the project is not such as in the judgment of the commission will be best adapted to a comprehensive scheme of improvement and utilization for the purposes of navigation, water-power development and of other beneficial public uses: provided, however, that priority in the respect last named will be maintained if within a time fixed by the commission the permittee modifies its plans as required by the commission.

The following substitute for Section B of Regulation 6 was proposed:

Priority established by preliminary permit may be lost if there is failure to fulfill the requirements of the permit, or if the proposed conditions of the license as set forth in the preliminary permit are not accepted within the term of the permit.

After discussion it was apparent that the section will be left in original form.

Section F of Regulation 7 was drafted as follows:

F. Upon a satisfactory showing of reasons therefor the commission may authorize permittees to perform such construction work as may be necessary to maintain water rights under state law, or as may be desirable in preparation for the construction of project works; but neither the granting of such authority nor the performance of such work shall be deemed to have created any equities or to have established any rights beyond what would have been created or established had such authority not been given or such work not been performed.

The following substitute was submitted:

Upon a satisfactory showing of reasons therefor the commission may authorize permittees to perform such construction work as may be necessary to maintain water rights under state law, or as may be desirable in preparation for the construction of project works; but the granting of such authority shall not be deemed to have created any equities or to have established any rights beyond what would have been created or established had such authority not been given.

After discussion it was agreed that the original regulation should stand, with the omission of the words "nor performance of such work."

Increased Freight Rates Throw Burden on Utilities

THE 40 per cent increase in Eastern freight rates which becomes effective next week will add greatly to the coal costs of the utility companies. Typical examples are the Potomac Electric Power Company and the Washington Railway & Electric Company, which use 215,000 tons of coal annually, on which there will be an increased cost of 90 cents per ton, a total additional cost of $193,500. The New York Edison Company and the United Electric Company and allied companies in Manhattan, using 1,500,000 tons of coal per year, will have an increased expense of $1,302,000. The Public Service Electric Company of New Jersey, will pay 80 cents additional per ton on 1,200,000 tons, total added cost of $960,000. At 1920 contract prices

the freight increase will add approximately 14 per cent to coal prices.

During July the total figures of all bituminous operators reporting to the Geological Survey show outputs of only 55 per cent of full-time production. Of the loss 25 per cent was due to transportation disability and 4 per cent to labor shortage. Movement of coal to New England tidewater during the first week of August reached 256,000 tons, with exports 490,000 net tons. In June, which is now reported completely, the New England movement was 772,000 tons. Lake shipments for 1920 are 5,500,000 tons behind 1918 and 6,750,000 tons behind 1919. Up to date, since the opening of navigation, dumpings at Erie ports stand at 7,647,000 tons.

Interstate Commerce Commission Extends Open-Top-Car Order

AS HAD been anticipated, the Interstate Commerce Commission has extended for an additional thirty days the order giving coal mines the first call on open-top cars. The commission declined to amend its order providing that cars be assigned for the daily needs of public utilities so as to extend this privilege to the shipment of coal to be stored for winter needs.

Coal Supply of New York Utilities Shows Slight Improvement

COAL on hand in reserve by the public utilities of New York City on Aug. 17, as reported by the Public Service Commission, was: Brooklyn Rapid Transit Company, 6,689 tons, five days' supply; Interborough Rapid Transit Company, 11,207 tons, five days; Richmond Light & Railroad Company, 384 tons, three days; New York Steam Company, 3,228 tons, six days; New York Edison Company, including United Electric Light & Power Company, 89,284 tons, twenty-three days; Brooklyn Edison Company, 55,524 tons, fifty-five days; Kings County Lighting Company, 184 tons, eleven days; Consolidated Gas Company, 35,147 tons, thirty-two days; Brooklyn Union Gas Company, 600 tons, fifteen days; Brooklyn Borough Gas Company, 404 tons, fifty days.

This report is dated Aug. 17 and shows a total among all the utilities of the New York City district of 273,313 tons of coal on hand as of that date. This is an increase of 13,506 tons over the previous week.

Acting Commissioner Barrett, in discussing the coal situation with a representative of the ELECTRICAL WORLD, said: "While an improvement is shown, it is slight and is not by any means what could be desired. The public utility companies are fully 159,000 tons below the stocks they should have at this time of year. In order to pass through the winter with a safe margin the companies should have about 800,000 tons on Oct. 1."

He further pointed out that the total amount of coal on hand when lumped together is only about ten days' supply for all the utilities and that under the present regulations they were permitted to receive daily only sufficient coal for that day's operation, which does not allow any coal to be stored. Commissioner Barrett also stated that at the present no hard coal was being received in New York City and that very few private property owners had been able to put in their winter supply of coal for heating purposes. To provide hard coal for this purpose cars now used for soft coal shipment must be diverted to the anthracite fields."

A. I. E. E. Committee Appointments by President Berresford

AT THE first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning Aug. 1, 1920, held in New York, on Thursday, Aug. 12, President Berresford appointed committees for the administrative year. The chairmen of the committees appointed are as follows:

Finance—Charles Robbins, assistant sales manager Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Meetings and Papers—W. I. Slichter, professor of electrical engineering Columbia University, New York.

Publication—N. A. Carle, chief engineer Public Service Electric Company, Newark, N. J.

Board of Examiners—Clayton H. Sharp, technical director Electrical Testing Laboratories, New York.

Sections—J. B. Fisken, chief engineer Washington Water Power Company, Spokane, Wash.

Student Branches—C. Francis Harding, professor of electrical engineering Purdue University, Lafayette, Ind.

Membership—E. H. Martindale, president and general manager Martindale Electric Company, Cleveland, Ohio.

Public Policy—H. W. Buck, consulting engineer Vielé, Blackwell & Buck, New York.

Law—Samuel Sheldon, professor of physics and electrical engineering Polytechnic Institute, Brooklyn, N. Y.

Headquarters—W. A. Del Mar, chief engineer Habirshaw Electric Cable Company, New York.

Safety Codes—Farley Osgood, vice-president Public Service Electric Company, Newark, N. J.

Code of Principles of Professional Conduct—George F. Sever, Jackson & Moreland, Boston, Mass.

United States National Committee of International Electrotechnical Commission—C. O. Mailloux, consulting engineer, New York.

Standards—D. C. Jackson, Massachusetts Institute of Technology, Boston.

Co-ordination of Institute Activities—L. T. Robinson, engineer General Electric Company, Schenectady, N. Y.

Economics of Electric Service—Philip Torchio, chief electrical engineer New York Edison Company, New York.

Educational—C. E. Magnusson, professor of electrical engineering University of Washington, Seattle, Wash.

Electrical Machinery—B. A. Behrend, consulting engineer, Boston, Mass.

Electrochemistry and Electrometallurgy—F. A. J. Fitzgerald, president Fitzgerald Laboratories, Inc., Niagara Falls, N. Y.

Electrophysics—F. W. Peek, Jr., consulting engineer General Electric Company, Pittsfield, Mass.

Industrial and Domestic Power—A. G. Pierce, Cutler-Hammer Manufacturing Company, Pittsburgh, Pa.

Instruments and Measurements—F. V. Magalhaes, superintendent testing department, New York Edison Company, New York.

Iron and Steel Industry—W. F. James, sales engineer Westinghouse Electric & Manufacturing Company, Philadelphia.

Lighting and Illumination—C. E. Clewell, University of Pennsylvania, Philadelphia.

Marine—Arthur Parker, electrical engineer New York Shipbuilding Company, Camden, N. J.

Mines—Graham Bright, engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Power Stations—H. P. Liversidge, assistant chief engineer Philadelphia Electric Company, Philadelphia.

Telegraphy and Telephony—Donald McNicol, editor *Telegraph and Telephone Age*, New York.

Traction and Transportation—Charles S. Ruffner, vice-president North American Company, New York.

Transmission and Distribution—E. B. Meyer, assistant to chief engineer Public Service Electric Company, Newark, N. J.

Senate Committee Investigating Coal Situation Among Utilities

HEARINGS in the coal situation have been held in several sections of the country by the Senate Committee on reconstruction and production similar to the one reported in the ELECTRICAL WORLD for July 31, page 252, at which John W. Lieb, vice-president of the New York Edison Company, outlined the coal situation in New York City. Meetings were held at Baltimore, Aug. 18, and Philadelphia, Aug. 19. For Aug. 30 in the Federal Building at Boston another hearing is scheduled.

Nebraska Section, N. E. L. A., Prepares Comprehensive Program

FOR its annual convention, which will be held at the Fontenelle Hotel, Omaha, on Sept. 8 and 9, the Nebraska Section of the National Electric Light Association has prepared the following program:

WEDNESDAY, SEPT. 8

Morning.—Address of welcome by Mayor E. P. Smith; "Central-Station Merchandising," by T. E. Roach, Union Light & Power Company, discussion led by W. S. Byrne of the Nebraska Power Company and M. A. Curran of the Western Electric Company; "Legal Obligations of the Central Station," by J. A. C. Kennedy, Nebraska Power Company; "Promotion and Development of Rural Transmission Lines," by S. H. Brooks, Continental Gas & Electric Company, discussion led by A. J. Cole of the Platte Valley Power Company.

Afternoon.—Electric field day at the Omaha Field Club, with golf matches and horseshoe-pitching contests.

Evening.—Dinner at the Omaha Field Club, J. E. Davidson toastmaster. A discussion on "Public Relations in Nebraska" will be led by W. B. Roberts, president Union Power & Light Company; Horace M. Davis, Nebraska Committee on Public Utilities Information, and L. R. Wilson, general commercial superintendent Nebraska Telephone Company.

THURSDAY, SEPT. 9

Morning.—"The National Association," by M. H. Aylesworth, executive manager N. E. L. A.; address by Thorne Browne of the Nebraska Railroad Commission; "Illuminating Engineering and Lighting Development," by H. E. Mahan of the General Electric Company; reports of committees.

Afternoon.—Luncheon at the Fontenelle Hotel; executive committee meetings.

Members and guests are invited to inspect the power plant and new electric shop of the Nebraska Power Company on Thursday afternoon. A large attendance at the convention is expected from Iowa as well as Nebraska, and co-operation from jobbers and dealers is looked for. Telephone, railway and gas interests are joining with the electric fraternities to further the work of the Nebraska Committee on Public Utility Information.

Meeting of Utility Men of Northwest at Spokane

PLANS for the thirteenth annual convention of the Northwest Electric Light and Power Association at Spokane, Wash., Sept. 8 to 11, include a meeting of the new hydraulic power committee of the National Electric Light Association. The following Western engineers are members of this committee: Markham Cheever, Salt Lake City, Utah, chairman; J. B. Fisken and B. M. Merrill, Spokane, Wash.; H. H. Schoolfield, Portland, Ore.; G. C. Sears, Seattle, Wash.; H. A. Barre, Los Angeles, Cal.; J. P. Jollyman, San Francisco, Cal., and C. O. Poole, Riverside, Cal.

President J. B. Fisken of the association reports that invitations to attend the convention have been sent to Martin Insull, president of the N. E. L. A., and M. H. Aylesworth, executive manager. Details of the program as thus far arranged are as follows:

WEDNESDAY, SEPT. 8

Morning.—Routine reports and address of President J. B. Fisken.

Noon.—Address by N. E. L. A. official before Spokane Advertising Club.

Afternoon.—Report of the Accounting Section, J. S. Simpson chairman; review of N. E. L. A. range and water heater report, A. C. McMicken.

THURSDAY, SEPT. 9

Morning.—Report of Hydro-Electric and Technical Section, G. E. Quinan chairman.

Afternoon.—Discussion of above report; safety report.

Evening.—Address on a public utility subject.

FRIDAY, SEPT. 10

Morning.—Report of advisory committee on co-operation of electrical interests, R. W. Clark chairman.

Afternoon.—"Public Utilities Competition," George L. Myers, Public Relations Section; "Successful Public Utility Management of the Future," Franklin T. Griffith.

Evening—Annual banquet at Davenport Hotel

An extensive entertainment program has been arranged including a competition on Saturday, Sept. 11, at Hayden Lake for the Kilowatt Golf Club cup. Provisions are also being made for the guests to visit the Interstate Fair, which will be held in Spokane the same week.

Rocky Mountain Section, N. E. L. A., to Meet with Colorado Association

AT THE Hotel Colorado, Glenwood Springs, Col., Sept. 13 to 15, the Rocky Mountain Section of the N. E. L. A., which was formed last year, will hold its convention jointly with the Colorado Electric Light, Power & Railway Association. Matters of general interest will be taken up at joint sessions, but all business sessions of both organizations will be held separately. These arrangements were decided upon at an executive committee meeting of the Rocky Mountain Section in Denver, Col., Aug. 3. At that time the following chairmen of special sections were appointed:

Public Relations Section—Bulkeley Wells, president Western Colorado Power Company, Denver.

Technical Section—T. O. Kennedy, general superintendent Denver Gas & Electric Light Company.

Tacoma City Officials Refuse to Discontinue Sale of Ranges

AGAINST the complaint of local dealers in electrical appliances, the city officials of Tacoma, Wash., are continuing a policy of selling electric ranges direct to consumers. Commissioner Ira L. Davison of the light and power department has ruled that it is the right of the city to cut the high cost of living by providing ranges at a small increase over the wholsale price. It is said that the city buys ranges cheaper than any other purchaser on the Pacific Coast because of the volume of its business. Mr. Davison asserts that the city is 140 ranges behind in its orders.

New President of Pacific Gas & Electric Company Changes Personnel

ALTHOUGH the appointment of a new president of the Pacific Gas & Electric Company, San Francisco, Cal., has brought about no change of management or policy, several promotions have been made. One of the first acts of the new president was to appoint Frank A. Leach assistant general manager. Mr. Leach was formerly manager of the Alameda district, which is the largest of all the districts, embracing all of Alameda and Contra Costa Counties and parts of Solano County. Lee H. Newbert, formerly manager of the commercial department, has been appointed to fill the position of manager of the Alameda district. Mr. Newbert is well known through his work with the California Electrical Co-operative Campaign and is at present president of the Pacific Coast Section of the N. E. L. A. Earl Fisher has been appointed to the position of manager of the commercial department. Mr. Fisher is chairman of the Commercial Section of the Pacific Coast Section, N. E. L. A., and has been assistant manager of the commercial department for several years.

Ontario Hydro Commission Will Not Build Auxiliary Steam Plant

DECISION has been made by the Hydro-Electric Power Commission of Ontario not to proceed with the construction of the proposed auxiliary steam plant in the Niagara Falls district. Several reasons are given for this action. The final tenders received indicated that instead of a capital cost of about $4,000,000 for the initial 50,000-hp. unit the work would cost in excess of $5,500,000.

Besides the high cost of labor and material the commission set forth the following additional reasons for not proceeding: The guarantees of earliest deliveries by the various companies tendering would not permit of the plant being constructed and ready for operation earlier than December, 1921. Moreover, it was estimated that the high cost of operation and the price of coal, as well as the cost of installation, would add at least $10 per horsepower to the cost of power in the Niagara district.

Hugh L. Cooper & Company, who are preparing an extensive report on the Chippawa-Queenston development at Niagara Falls, have advised the commission that the two units of 55,000 hp. each will be ready for commercial operation on Oct. 1, 1921, provided that there is no further interference with construction.

Cape Cod Properties Consolidated

UNDER the name of the Cape & Vineyard Gas & Electric Company, the Buzzards Bay Electric Company and the Cape & Vineyard Lighting Company have been consolidated, with the approval of the Massachusetts Department of Public Utilities, in the interests of better and more economical service. The two properties are under the management of the Carpenter interests, with headquarters at Falmouth, Mass. The Vineyard company serves a portion of the island of Martha's Vineyard, and the Buzzards Bay company serves the territory between the Cape Cod Canal and Chatham. It is planned to interconnect the two by submarine cable, so that energy from the tidewater steam plant of the New Bedford Gas & Edison Light Company will be available on Martha's Vineyard.

Starting of Kerckhoff Station Breaks Three-Year Power Famine

THE new Kerckhoff project of the San Joaquin Light & Power Corporation of Fresno, Cal., was put into operation Sunday, Aug. 15, at Auberry, 40 miles from Fresno, before 2,500 invited guests, who made the trip over mountain roads to the project, coming from all parts of the state. This is believed to be the largest assemblage that ever attended a ceremony of this kind in the State of California. Four hundred and eighty-five automobiles were required to carry the party.

The big 14,200-kva. generators were started by two switches mounted on a platform under a large canopy spread beneath pine trees a mile from the power house. William K. Kerckhoff, president of the corporation, after whom the project is named, assisted by R. C. Starr, Jr., son of the construction engineer who built the project, closed the switches. A huge electric sign spelling the name "Kerckhoff" was mounted above the platform. As the generators gathered momentum the lamps in the sign changed from a faint red to bright white, while the crowd cheered and detonations of dynamite rent the air. An arc with a 6-in. gap flashed forth, while four aëroplanes equipped with radio telephone and telegraph instruments circled above, announcing to the San Joaquin Valley that the "power famine" of three years' duration had been broken.

A short program of speaking preceded the starting of the generators. General Manager A. G. Wishon, chairman of the day, outlined the history of the company and told of the efforts to finance the necessary development, inviting the public to become partners in the corporation in its future developments. Col. H. D. Loveland of the State Railroad Commission, in a short talk, called attention to the novel situation in which purchasers of securities of the power company find themselves. "You are our boss," said Commissioner Loveland. "If you become a partner with Mr. Wishon in the power company, you are our boss and we are under your jurisdiction. We realize that the rates of the public utilities have been whatever their commission saw fit to charge, and we have regulated them without fear or favor and according to conditions as we find them. I want to ask you how this commission could inflict a more serious evil on the State of California than to impose rate conditions that would not permit of a fair rate of return? Such a policy would halt development."

R. C. Starr, construction engineer, received an ovation as he mounted the platform to thank the organization for its help in completing the job sixty days in advance of schedule. Other speakers were: Chester Rowell, editor of the Fresno *Republican*, and A. C. Balch, vice-president of the corporation. Among the notable guests were Congressman John E. Raker, one of the sponsors for the recently enacted water-power bill. Mr. Raker expressed his admiration for the scale on which operations are conducted by the San Joaquin Light & Power Corporation at its Kerckhoff project. Congressman H. E. Barbour of Fresno accompanied Mr. Raker on his inspection of the work.

American Tractors in Formosa.—About twenty electric tractors of American make are now in service in the island of Formosa. These range in size up to about 75 hp. They are used on sugar plantations and are said to be giving such good satisfaction that many more are likely to be ordered.

Standardization in Great Britain.—Though only two years old, the British Engineering Standards Association reported excellent progress at a recent annual meeting. Forty-five standard specifications for electrical apparatus alone are in course of preparation under the auspices of the society, which covers all branches of engineering in its work.

Wisconsin Commission Picnics.—A picnic participated in by all the departments of the Railroad Commission of Wisconsin was held on Tuesday afternoon, Aug. 3. Races, tugs of war and a baseball game followed by supper and dancing were the features of the event. The contests were participated in by every one, including the members of the commission and women as well as men employees.

A Bright Town.—Bucyrus, Ohio, has less than 10,000 population, but its new lighting system, comprising 502 units, of which 114 are 600-cp. lamps mounted on single-unit "white way" standards, has placed it among the best lighted places of its size in the United States. The lamps burn all night and every night, on a 4,000-hour schedule, with the exception of one-half of those composing the "white way," which go out at midnight.

The New English Electricity Districts.—The division of England into "electricity districts" under the provisions of the new act is proceeding rapidly and the boundaries of a number of such districts have been announced. What is doubtless the most important division of all—the "London and Home Counties" division—takes in roughly the territory within a 25-mile radius of the metropolis, including a tremendous population and many manufacturing sections.

Political Workers Will Use Electric Signs in Campaign.—The Cox Electric League, a political organization composed of electrical workers, has determined upon a plan to boost its candidate by means of electric signs to be put up throughout the country. The signs will consist of a circle containing the letter X. First three-quarters of the circle, forming the letter C, will be illuminated; then the entire circle, forming the "O," and finally the "X," thus completing the name of the Presidential nominee.

Prone-Pressure Method of Resuscitation Proves Its Value.—Frank Grinnell, the substation operator of the Consumers' Power Company at Muskegon, Mich., was closing the 72-kv. air-break switches on a 5,000-kva. bank of transformers recently when lightning caused a flash over the insulators supporting the switch, the flash jumping to the steel framework and thence to the frame around the outdoor oil switch. The surface of the ground was damp from rain and Mr. Grinnell and Mr. Nelson, the substation foreman, were knocked down. Grinnell came into contact with the framework and was rendered unconscious. Fortunately the employees of the company are trained in the use of the prone-pressure method and Nelson at once put his knowledge into practice. After he had worked over Grinnell for ten or twelve minutes normal breathing was restored.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Grasping the Idea.—The display card here reproduced has been issued by the promoters of the New York Electrical

Show to advertise that annual event, which this year will take place in the Grand Central Palace, New York City, from Oct. 6 to Oct. 16.

Production of Copper Decreased in 1919.—The advance statement of the production of copper in the United States last year issued by the Geological Survey puts the smelter output at 1,310,972,580 lb, compared with 1,908,533,595 lb. in 1918 and 1,886,120,721 lb. in 1917. The total production of refined copper was 1,768,000,000 lb., a decrease of 665,000,000 lb. as compared with 1918. The four leading states in copper mining are Arizona with 536,000,000 lb., Michigan with 201,000,000 lb., Montana with 175,000,000 lb. and Utah with 146,000,0000 lb. The value of the total output was $243,731,000.

Increases in Electric Rates.—The Rockford (Ill.) Electric Company has received authority to increase its power rates 30 per cent temporarily pending a further hearing. Flat rates in North Baltimore, Ohio, have gone up 20 cents a month. An order has been issued by the Public Service Commission of West Virginia granting increased electrical rates to the Wheeling Public Service Company. The rates applied for were granted except that the minimum monthly charge for electrical service was made 75 cents instead of $1. The Montana Public Service Commission has refused the request of the Helena Light & Railway Company for a suspension of electric rates in that city.

Standardization of Supply Pressures in Switzerland.—As the result of meetings held this summer by the electrical bodies of Switzerland, a standard of low-pressure supply for that country has been virtually agreed upon, the potentials adopted being 125, 220 and 350 volts for alternating current and 110, 220 and 440 volts for direct current. It is recommended that old plants be extended and new ones constructed according to this decision.

An "Electric Eye."—Taking advantage of the fact that in the dark the electrical conductivity of selenium is low while it is increased by light, the degree of conductivity varying with the brightness of the light, Eugene Steiger, an inventor who recently arrived in the United States from Zurich, Switzerland, has perfected, according to claims said to have been demonstrated recently before engineers and other witnesses, a selenium-cell apparatus known as an "electric eye." By placing this contrivance in an electric circuit switches for street lamps, lighthouse signals or burglar alarms are turned on automatically, it is said, and when light again appears the switches are automatically turned off.

Electricity in the Arctic Regions.—The projected hydro-electric plants on the south coast of Iceland, about 60 miles from the capital, Reykjavik, will apparently be a degree or so further south than the oil-burning plant of the Alaskan Industrial Mining & Power Company at Nome or the water-power development of the Canadian Klondyke Power Company above Dawson, which are within 200 miles of the Arctic Circle; but if developed on anything like the scale announced the Iceland plants will far eclipse in size those just named and all other Far Northern installations. Even if the six Icelandic plants, with a possible utilization of 1,000,000 hp., that are talked about come to be built and find in the fixation of nitrogen for fertilizing purposes a reason for being, only a fraction of the vast potential water power of the ice-bound regions will be utilized.

Woes of the Meter Reader in India.—That the lot of Hindu meter readers in British India is not a happy one is apparent from the complaint made by one of them, printed in an English contemporary. Among the drawbacks and dangers of the calling he enumerates "insults from consumers," "being bitten by dogs," "falling from ladders" and "banging of doors in the face." Moreover, there are incessant delays. "Many a time," says the unfortunate native, "butlers would not condescend to reply at once till after some time they take pity and answer that either the lady inside is dressing or taking bath, or the inmates are asleep, and I had better call after some hours or on the next day. Some meters are placed in dirty lumber rooms, some in bathrooms and lavatories, some in bedrooms, others again in kitchens, where a beef is being cooked when a Hindu meter reader goes round."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Value Not Determined by Character of Service.—Accrued depreciation, the Montana Public Service Commission recently observed, cannot be ignored in a valuation for rate-making purposes on the theory that a plant, although old, is as valuable as a new plant if it gives 100 per cent efficiency in operation, since the character of the service rendered does not determine value.

Where a Valuation Is Unnecessary.—The Pennsylvania Public Service Commission recently asserted, in passing upon an electric railway's application for increased fares, that it would not require a utility to incur the expense necessary to a valuation proceeding in cases where the evidence showed that an increase was necessary to pay the operating expenses without including any provision for a return on the investment.

Expenses of Outside Management Disallowed.—The Montana Public Service Commission has refused to allow as operating expenses of a utility operating gas, electric and street-railway departments a fee of 7½ per cent of the net earnings paid to a New York management, together with excessive traveling and other expenses of the directors, where the affairs of the three utilities were managed locally by a combined general manager and attorney, each department having a superintendent and there being a full office staff.

Allocating Property of Electric Light and Water Company.—In apportioning the property of the Gardiner Light & Water Company as between the water and electric departments the Montana Public Service Commission proceeded on the basis of the time user. It based the valuation of the combined electric and water utility on the "actual cost" theory where the existing plant would not be reproduced from an engineering standpoint at the present time under any circumstances and no claim was made for appreciation in plant value due to recent abnormal conditions, and where there was also satisfactory evidence as to the original cost.

Rural Extensions and Rate of Return.—In ordering that the amended rules of the Wisconsin Power, Light & Heat Company and other companies relating to rural extensions be placed on file, subject to investigation in case of complaint, the Wisconsin Railroad Commission observed that the necessity for a rate increase should be very urgent before the authorization of any rate higher than that specified in a contract between an electric utility and rural consumers in cases where all or a part of the construction costs of the extension required to serve such consumers had been advanced by them. To encourage the development of such service, however, it must be permitted to earn the same rate of return as the urban business of the company, while at the same time terms as to financing must be permitted which will make possible the immediate investment of considerable sums of money without taxing the resources of the utility for obtaining capital.

Energy Charge Favored When Shortage of Supply Exists.—In case of a shortage of the supply of electricity the California Railroad Commission holds that an energy form of rate should be adopted, especially in the case of agricultural consumers, in order that the cost of service may be equitably divided between those who continue to use the power freely and those who curtail their consumption.

Proper Ratio of Consumers to Population.—Granting increased rates to the Western Hydro-Electric Company, the Michigan Public Utilities Commission said that the rates fixed would yield a reasonable return provided the company so managed its property as to obtain its reasonable quota of consumers. This in the case of electric customers the commission put for the community in question at the ratio of one to every five in the population, whereas the present ratio was only one to nine. The commission also criticised the management of the company because only two-thirds of its existing customers were metered and said that all customers should have meters and flat rates be abolished. A well-put *obiter dictum* of the decision referred to the "twilight zone" between rates so low as to be confiscatory and so high as to be oppressive, in which zone the judgment of the commission may operate without judicial interference.

Recouping Street-Railway Losses from Electric Department Earnings.—In justification of its decision not to determine the rates for the divisions of the Helena Light & Railway Company on a separate basis the Montana Public Service Commission said: "Confiscation or deprivation of property contrary to the constitutional right begins when the revenue derived from rates prescribed is less than legitimate and necessary operating expenditures; and a rate theoretically sufficient for each utility alone would have the precise effect of producing revenues below operating requirements, at least in so far as the street railway is concerned. . . . We are satisfied that patrons of the Helena Light & Railway Company would rather recoup street-railway losses out of electric earnings than abandon the railway system for greatly decreased light and power rates. It must be distinctly understood that we yield the principle of separation only because of the facts of this particular case and only for so long as necessary."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Powers of Michigan Railroad Commission.—In an action brought against the Michigan Railroad Commission by the city of Detroit the Michigan Supreme Court declared that the commission was not deprived of the power to fix the rates of a utility because it was operating within the limits of a city under a home-rule charter. It is proper, the court held in the same case, to fix the value of a utility's property on the basis of the present market values as to land and reproduction cost less depreciation as to structures. (177 N. W. 306.)

Contracts Not Voided by Change in Form of City Government.—In the suit of the city of Mobile against the Mobile Electric Company to restrain the city from holding an election to vote on a proposed ordinance affecting the company's franchise, and to obtain a decree that an agreement adopted in 1918 to suspend the operation of the original contract between the city and the company until the end of the war (the Alabama Public Service Commission to be asked to fix just and fair rates) is still valid, the Supreme Court of Alabama affirmed the order of the lower court granting a temporary injunction. The case was affected by the facts that a technical state of war still exists and that a commission form of government has taken the place of the former Mayor and Council in Mobile. Among the findings of the Supreme Court were, in effect, these: (1) Where the Public Service Commission changes a subsisting rate pursuant to an agreement between a municipality and a public service corporation the validity of its action must depend on the legality of the agreement; (2) a contract resolution not signed in the name of the city but merely by commissioners purporting to act for it is one which is not merely defective or irregular but is no contract; (3) where the resolution of city commissioners attempting to suspend a contract for furnishing light to city residents was a nullity an election to adopt an ordinance to reinstate the original contract would be useless and could be enjoined; (4) the provisions of the code affecting contracts do not apply only to cities operating under the aldermanic form of government since they affect also contracts in other instances and through officials other than mayors; (5) where there was no substantial or even attempted compliance with one of the most important and mandatory requirements of the code relating to city contracts the agreement was void. (84 S. 816.)

M. Luckiesh, heretofore physicist of the Nela Research Laboratory at Cleveland, has as a result of reorganization of the laboratory and expansion of its work been appointed director of applied science and will have charge of a separate laboratory. This laboratory of applied science and the new laboratory of pure science will hereafter constitute together the Nela Research Laboratory. Dr. Nichols will be director of the pure-science laboratory, and the work of both laboratories will be co-ordinated under the general direction of Dr. E. P. Hyde. Mr. Luckiesh's appointment is in recognition of the able work which he has rendered to the industry in the field of lighting. Himself a scientist, Mr. Luckiesh has done a great deal in linking together the science and the art of illumination

M. LUCKIESH

through original studies and investigations. He was born in Maquoketa, Ia., Sept. 14, 1883, and was graduated from the Iowa State College in 1905. He entered Purdue University in 1906 and was graduated with the degree of B.S. in E.E. After a year of teaching in the State University of Iowa he entered the Nela Research Laboratory in 1910. In 1911 he obtained an M.S. degree from the State University of Iowa and in 1912 an E.E. degree from Iowa State College. Mr. Luckiesh has devoted a great deal of attention to the study of colors. He has written many papers and the following authoritative textbooks on lighting and color: "Light and Shade," "Color and Its Applications," "The Language of Color and the Lighting Art," and "Artificial Light—Its Influence on Civilization."

Michio Izawa, assistant traffic manager for the Japanese government railroads, and Kukujiro Hirayama, railway engineer of the imperial lines of Tokio, are visiting America and studying the American railroad systems. They are particularly interested in electrification of steam railroads since Japan must import its supply of fuel and the mountainous sections permit the development of a large amount of hydro-electric power.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. G. Wishon, general manager of the San Joaquin Light & Power Corporation, Fresno, Cal., who formally started the company's Kerckhoff station of 42,600 kva. on Aug. 15, was one of the first investigators of water powers in the High Sierras. He was born at Coppeges Mill, Mo., Nov. 6, 1858, and went to California in 1889. In 1894 he became interested in an irrigation project that required the building of a 1,100-hp. power station for pumping water out of the Kaweah River. In working out this project he began to survey the power possibilities of the High Sierras and to lay plans for the development of what has since proved to be the great source of power for the entire San Joaquin Valley and the city of Los Angeles. Like other Western pioneers, he found the securing of capital one of the great drawbacks. With the assistance of John Hays Hammond, however, in 1898 he organized the Mount Whitney Power Company, and as manager of that company he completed the construction of its first plant in June, 1899, 31 miles from Visalia, 42 miles from Portersville and Tulare, the chief points of distribution. A second power station was later started, but Mr. Wishon resigned in September, 1902, when it was about half completed, to develop other power sites on the Tule River south of the Mount Whitney projects and became associated with W. G. Kerckhoff and A. C. Balch, capitalists of Los Angeles. In January, 1903, Messrs. Kerckhoff and Balch purchased the railway and water properties in Fresno, Cal., and the San Joaquin Power Company. Later the railway interests were sold to the Fresno Traction Company, and the San Joaquin Light & Power Corporation was organized with Mr. Wishon as general manager, the position he still retains. Associated with him in the management of the company is his son, A. Emory Wishon, whose development of the self-interest basis for financing public utilities, as presented in the May 1, 1920, issue of the ELECTRICAL WORLD, has created widespread interest in the East as well as the West. In addition to his activities as a public utility man, A. G. Wishon is identified with other interests as director of the California Raisin Company and proprietor of extensive vineyards and farming property in the San Joaquin Valley. Other details of Mr. Wishon's contributions to the development of the resources of this district, almost entirely dependent upon electric service, appears in this issue on page 368.

Dr. Ernest Fox Nichols, formerly president of Dartmouth College and more recently professor of physics at Yale, who early this year joined the staff of the National Lamp Works of the General Electric Company, Cleveland, has accepted an invitation to assume the immediate direction of the laboratory of pure science of the National Electric Lamp Association under the title of director of pure science. The laboratory of pure science and the laboratory of applied science, which together will constitute the Nela Research Laboratories, will be under the general direction of Dr. Edward P. Hyde, who organized the Nela Research Laboratory in 1908 and who now becomes its director of research. Dr. Nichols was born at Leavenworth, Kan., in 1869, was graduated in 1888 from

DR. E. F. NICHOLS

the Kansas Agricultural College, and after graduate study at Cornell University spent three years at the University of Berlin. He received the degree of doctor of science from Cornell in 1897, and was professor of physics at Colgate University for six years before taking the chair at Dartmouth in 1898. Dr. Nichols later became professor in experimental physics at Columbia University, and about ten years ago he was made president of Dartmouth. Early in 1916 he resigned to accept a professorship of physics at Yale University, which position he held until he joined the Nela Research Laboratory. He has made many notable researches, the best-known being the invention of a radiometer for stellar measurements.

Obituary

E. H. Mulligan, district manager of the Southern California Edison Company at Redlands, died July 12 after a long illness. Prior to his affiliation with the Edison company in 1908 he was connected with the earliest hydro-electric installations in California.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Household Appliance Manufacturers Aim to Develop New Devices

MANUFACTURERS of motor-driven household devices see a big future ahead of them, both at home and abroad. The demand for such leaders as washing machines and vacuum cleaners seems to have reached its peak in this country, where the manufacturing capacity of existing factories will with one or two exceptions probably be sufficient to take care of all future domestic requirements. However, there is an insatiable foreign demand still untouched, and factory extensions now being made by household-device manufacturers are mainly to supply this demand.

Manufacturers are looking around for new devices with which to supply their domestic customers. Dish-washing machines, domestic refrigerating machines and electric ironing machines are among those being considered, but they all seem to require a large outlay of capital either to develop the machines or to stimulate demand.

This quest of manufacturers for new lines may lead to the development of entirely novel electrical labor-saving devices or to the further development of devices now on the market. However, for the manufacturers who simply continue to increase the output of their standard products, there seems to be a foreign market large enough to absorb whatever part of their output cannot be sold in this country.

Uneven Conditions in Industrial Reflector Market

INQUIRIES instituted among manufacturers of industrial reflectors in making a comprehensive survey of the field reveal uneven conditions in that line. Varying reports are received as to the volume of sales that are being made at present, the condition in which stocks of finished reflectors are to be found and the rapidity with which deliveries can be made. Producers generally seem to concur in an optimistic feeling regarding the future of the industry, however, because, according to them, industrial lighting today is tending more and more toward standardization and plants are at the same time realizing that proper lighting is an important factor in promoting efficient production.

The months of July and August are usually rather quiet for sales of reflectors, this being the period when stocks are reinforced in anticipation of the fall trade, which is somewhat heavier then. In spite of this, one of the large makers states that July was the biggest month in the history of his business and that the volume of orders received for the first five months of this year was three times as large as for the same period in 1919. Several other producers are also finding a good and fairly regular demand for their product, but this is not a universal condition as evidenced by other reports of "fair," "spasmodic," and in at least one case an answer of "poor," returned to the question regarding demand.

Stocks of finished reflectors on the whole appear to be in bad shape, with almost half of the manufacturers having absolutely no reserve stocks, and several others say their supply is poor or below normal, while in only one or two cases are favorable returns given, and then the statement is made with a qualification such as "good considering conditions." These conditions referred to are undoubtedly affecting production, and foremost among them seems to be the question of raw material. Occasionally one hears of some easing up of the shortage there, but for the most part companies are severely handicapped for lack of all or part of such material as fuel, metal, porcelain for sockets, etc. Transportation is also materially impeding the output of producers, the item of steel alone requiring many weeks to reach the factory.

In spite of these unfavorable conditions, at least as many manufacturers report a normal volume of production as those who say their output is below capacity, and in the latter case it is quite often added that the situation is improving. More than 50 per cent of the industry reports freedom from labor troubles, although in some instances where no strikes have been experienced, a shortage of skilled workmen is reported. Inasmuch as labor, raw material and transportation conditions naturally affect different manufacturers in varying degrees, the range of time in which deliveries can be made varies in almost every case. In one or two instances deliveries were quoted from stock up to two weeks, while the maximum length of time ran to three months and the majority of delivery figures would probably be encompassed within a range of about three to eight weeks.

Back orders are very numerous and some have even been held up as long as three or four months, although this is not usual. As a result cancellations have occasionally been made, though not to any great extent. Prices have held steady since general increases were made two to three months ago, and opinion is about evenly divided as to whether further advances will soon be necessary. Those who held the affirmative view base their belief on prevailing high prices of labor, metal, fuel, packing, etc. Collections in general are characterized as fairly prompt, though some complaints of slowness are registered and also of traces of tightening collections.

Record Exports of Switches in June

EXPORTS for all classes of electrical material with the exception of locomotives total $46,724,126 for the six months ended June 31, 1920, according to figures made public by the Bureau of Foreign and Domestic Commerce. This compares with a total of $48,608,056 for the first half of 1919 and with $27,857,184 for the corresponding period of 1918. Thus the first half of 1920 is running about 4 per cent less than 1919, but about 67 per cent more than 1918. Electrical exports for 1920 if continued through the year at the same rate as for the first half would result in a year's total of about $93,000,000, compared with an actual total of $89,000,000 last year.

An interesting comparison is afforded by the figures of various electrical goods exported during the past two and a half years. The total exports of motors, amounting to $6,113,900, for the first half of 1920 represent an increase of 5 per cent over the same period in 1919 and about 80 per cent over 1918. An excess of $438,000 in generators marks the first six months of 1920 in comparison with 1919, and $1,300,000 represents the increase over 1918. The present half year's figures on transformers, however, are about $349,000 below those for 1919, but are $654,000 above 1918.

Electrical heating and cooking appliances are also steadily increasing in favor abroad, as shown by the total of over $900,000 reached at the midyear mark in 1920, which

figure is approximately 13 and 230 per cent ahead of the same period in 1919 and 1918 respectively.

The June, 1920, total of exports for electrical goods is $9,011,949, which is the next to the highest monthly record, being exceeded only by the sum of $10,992,631 in June, 1919, which compared with $5,019,519 for the same month in 1918. The decrease of almost $2,000,000 between June of this year and last is largely accounted for by a drop of over four-fifths of a million on the item of insulated wire and cable and almost one-fifth of a million each on batteries, dynamos and metal lamps. Out of nineteen different items, the totals of the sixth month a year ago exceeded those of June, 1920, in fourteen. The largest excess among these twelve was about $827,000, or 139 per cent, on insulated wire and cable; but June of this year has to its credit the largest percentage increase over June, 1919, by exporting 4,375 per cent more arc lamps, though the record figure of $7,743 in itself is small. Another class of goods in which the exports of last June touch an unprecedented figure is switches, the total value of $608,330 excelling the best previous amount of $593,975, registered in June of 1919, by more than $14,000. Below is the comparative table for June, 1919 and 1920:

	June		Six Months Ended June	
	1919	1920	1919	1920
Batteries	$787,748	$578,146	$3,197,135	$3,334,810
Carbons	173,582	113,109	856,597	672,379
Dynamos and generators	760,546	571,340	2,560,411	2,997,764
Fans	130,817	191,434	995,838	717,698
Heating and cooking apparatus	192,551	164,344	814,002	921,575
Insulated wire and cable	1,420,699	593,370	5,590,056	3,683,653
Interior wiring supplies	280,631	270,709	1,257,182	1,514,820
Arc lamps	173	7,743	7,578	13,609
Carbon-filament lamps	5,176	4,518	113,171	58,463
Metal-filament lamps	530,085	364,864	2,824,812	2,054,812
Magnetos, spark plugs, etc.	219,826	290,723	1,680,382	1,919,442
Meters and measuring instruments	319,336	237,735	1,667,087	1,322,661
Motors	1,562,521	1,250,638	5,835,350	6,113,900
Rheostats and controllers	65,384	83,504	264,103	371,194
Switches and accessories	593,975	608,330	1,672,047	2,182,674
Telegraph apparatus	92,220	30,458	515,608	378,288
Telephones	377,395	275,212	1,892,059	1,914,641
Transformers	438,483	402,016	2,233,075	1,884,728
All others	3,041,383	2,973,756	14,631,563	14,667,015
Total	$10,992,631	$9,011,949	$48,608,056	$46,724,126

Supply of Rigid Conduit Offers No Immediate Relief

REPORTS received from jobbers in the metropolitan territory on the rigid-conduit situation within the past couple of weeks may, according to representative manufacturers, give an erroneous impression of the true general market condition of this material. A curious situation exists in that while the supply of conduit for New York and certain points to the south has materially improved, the general situation throughout the rest of the country apparently shows little betterment. This is only natural when the true significance of the improved supply in these instances is understood.

According to representative manufacturers of conduit, the transportation situation as it affects them is very little if any better. Added to this circumstance is the dwindling supply of pipe that has for some time past been available for the manufacture of conduit. Steel mills attribute the shortage to their inability to get cars for shipping their product to the makers of conduit. One of the latter has received no pipe for a month and a half, and another manufacturer has received no recent supplies except by boat. As a result of this lack of raw material caused by the car shortage, one of the large makers of conduit has ceased production during the past two weeks and another company has not turned out any conduit in over a week.

Prior to this, however, stocks of finished conduit had accumulated at the mills awaiting cars to carry it away, but a system of embargoes that was placed upon producers in the Middle West made it very difficult to move their product. At one time a permit was even necessary to ship the material. Recently, however, the situation has been relieved to the extent that shipments can be made to certain territory in the East and some points southward in a little better shape, although the car shortage continues and the rest of the country remains almost as restricted in its supply as before. Consequently, with the outlet to their market restricted, conduit manufacturers have shipped their product in large quantities to the metropolitan district, creating the misleading impression that exists among some jobbers to the effect that conduit is becoming very plentiful. This condition would seem to be but temporary, however, inasmuch as manufacturers say the unusual flow of conduit into the favored territory will cease as soon as freight conditions improve generally.

Regarding the general market for conduit over the country, no let-up in the insistent demand has as yet appeared, and in distant places like Cuba a condition of absolute famine prevails. New orders are accepted with no promise as to date of delivery and with price quoted in effect at time of shipment. Back orders have in some cases piled up sufficient to absorb production for nearly a year to come. The large labor turnover found among the many foreigners employed in this industry is a further source of inconvenience.

In spite of these factors, prices have generally remained firm, but some producers hold to the opinion that an advance may be necessary owing to the increased freight rates.

Metal Market Situation

LIGHT sales feature the copper market. Producers are holding for 19 cents through August, September and October, with very little interest being shown in deliveries beyond that date. The market seems under no more pressure to sell than to buy. Encouragement is gained from the improvement in freight conditions, which is allowing more shipments of metal on contract to be made.

In the outside market business is also extremely quiet, with prices nominal and scant inquiry being made for future positions. August shipments can be obtained for 18.50 cents, though this price may be shaded slightly as there is a little more pressure to sell for immediate shipment. The market at London has lately presented a dull tone, with standard spot slightly weaker in the last fortnight.

Increased prices on aluminum have gone into effect, amounting to slightly over 2 cents a pound on 98 to 99 per cent ingots. The zinc market presents a firmer tone, the price of spot taking a slight rise, and though demand at present is not very heavy, fears of a shortage are expressed because of car shortages and plants being closed by strikes. Not much buying strength is evidenced in tin, but the market apparently presents a very strong undertone.

There is not a great deal of lead in evidence in spite of the recent advance of ½ cent a pound. The market continues to hold firm.

Midsummer dullness is being intensified by unrest and transportation difficulties in the scrap-metal market, so that little activity is evidenced there. A slight decrease in the price of old zinc is noted.

NEW YORK METAL MARKET PRICES

Copper	August 10	August 17
	£ s d	£ s d
London, standard spot	93 10 0	93 5 0
	Cents per Pound	Cents per Pound
Prime Lake	18.75 to 18.85	18.75 to 18.85
Electrolytic	19.00	19.00
Casting	18.00	18.00
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.50	9.00
Antimony	7.00	7.00
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.15	8.35
Tin	48.25	48.00
Aluminum, 98 to 99 per cent	33.00	35.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 16.00
Brass, heavy	9.25 to 9.50	9.25 to 9.50
Brass, light	7.25 to 7.75	7.25 to 7.75
Lead, heavy	7.25 to 7.50	7.25 to 7.50
Zinc, old scrap	5.50 to 5.75	5.25 to 5.50

THE WEEK
IN TRADE

IN SPITE of midsummer trade dullness, which is everywhere slowing the market for electrical material, the volume of sales in almost every district is reported as considerably higher than the usual summer level of other years. The slump is noticeable only in the light of the exceptionally brisk business recorded earlier this year. The notable exceptions are in the Puget Sound and Intermountain sections, where extreme quietness features the industry. Even in the latter districts as elsewhere, however, optimism reigns as the result of the heavy trade which is expected to materialize with the coming of the fall months.

The credit situation seems to be characterized by the increasing tightness of money, and practically all districts are experiencing a slowing up of collections. The money stringency is expected to be alleviated in many parts of the country, however, with the harvesting of the good crops that are reported from all sections.

Southern territory is the only quarter where an appreciable amount of residential construction is under way, other districts seemingly being deterred by the prevailing scarcity and high prices of building material, although in the East a large volume of building for commercial purposes is under way.

Stocks are in general considerably improved, as lessened demand and slightly easier transportation makes itself felt, but a shortage of cars is causing great concern in the West and in the Northwest, where the car demands of the lumber and grain interests are considerable. Prices seem to be holding steady except for an increase of from 10 to 15 per cent on motors.

NEW YORK

Compared with the volume of business earlier this year, the electrical trade has been rather quiet the past week, but in comparison with the usual midsummer slackness of other seasons the amount of sales registered at present is very encouraging.

Local reports indicate a considerably easier transportation situation in both incoming and outgoing shipments, not that deliveries are being effected much more quickly than has been the rule, but orders placed perhaps months ago are now beginning to come through. As a result of better shipments and lessened demand, sizable stocks are accumulating in most lines, particularly in flexible armored conductor, lamps, rubber-covered and lead-covered wire and fuses. The rigid-conduit supply is also a little better in this territory.

Residence construction remains practically negligible, but thousands of homes are needed here and a large amount of work is on the boards. When the supply of building material eases up, as it seems reasonable to suppose it will, after the improved financial situation of the railroads has had time to make itself felt, a large amount of electrical material will be needed for the projects that are now planned.

Jobbers agree that collections are a bit tighter at present and must be pushed with more persistance, but the general situation with regard to payment of bills is characterized as fairly good.

Lamp Cord.—Good stocks of both silk and cotton material are reported, with only a fair demand. The greatest call seems to be for cotton cord, and hence silk is more plentiful, if there is any choice between the two. Shipments are coming in better on orders placed months ago.

Safety Switches.—Although many jobbers do not touch this article in local territory, demand in many quarters appears to be picking up considerably.

Non-Metallic Flexible Conduit.—Reports vary considerably, as some jobbers have good stocks and experience no difficulty in meeting the small demand they are finding, while others say that demand is good and at least one distributer has no stock, is sold out for the remainder of the year and is behind on filling orders. Prices quoted range all the way from $33 to $38 for the ⅜-in., and from $36 to $42 per 1,000 ft. for the ½-in. size.

Flexible Armored Conductor.—Fairly good stocks have now accumulated under the influence of lessened demand and better shipments. Prices are showing signs of softening, with No. 14 quoted in the neighborhood of $105 per 1,000 ft.

Fuses.—Demand, though not extraordinary, is probably close to normal, with reports varying as to which type sells the best. Good supplies of both renewable and non-renewable makes are on hand.

Wall Panels.—Some jobbers are finding a shortage, said to be caused by a dearth of sheet steel, but others have accumulated a good stock by anticipating their orders. Demand is about normal.

Rubber-Covered Wire.—Plentiful stocks are taking care of the fairly good demand which exists. Shipments are regular, although the larger sizes are a bit slower. No. 14 is quoted at $11.50 per 1,000 ft. in lots under 5,000 ft., and at about $11 for larger quantities.

Lighting Fixtures.—No trouble in obtaining supplies seems to be experienced in this line and stocks are in good shape. Demand is not especially heavy, though increased sales are looked for in about a month.

Lead-Covered Wire.—A fair demand is felt, with good stocks the rule. Shipments are slow, however. Price quotations cover a wide range.

Lamps.—Good prospects for a heavy fall trade are reported and many jobbers are already fully stocked up in anticipation of this demand. Others, however, have not yet been able to build up their supplies, although orders are said to be on the way.

CHICAGO

The electrical trade is keeping busy and prices are firm or on the raise, although Chicago's building permits for the current week maintained their low rate of $700,000 and many industries showed price losses and decreases in volume of sales. Some manufacturers, finding new building too expensive, are re-equipping and overhauling existing plants and thus maintain the demand for certain lines of electrical goods. As a whole, stocks are gradually improving and back-order files are being correspondingly lightened, but porcelain, glass, line hardware and certain power apparatus are extremely hard to get.

Credit conditions remain practically stationary. With efficient organization, close scrutiny of orders and prompt follow-up, collections are about the same as they were a year ago under much less active collection work. The financing of new projects in the agricultural districts is becoming increasingly difficult as banks are still loaded up with paper covering last year's grain.

Motors.—Recently noted advances in certain motors and generators have been followed by similar moves on the part of other manufacturers until now practically all sizes and styles above 1 hp. are 15 per cent higher than prices prevailing in June and July. A standard 5-hp., 1,800-r.p.m. induction motor is now quoted at $129. Fractional sizes have also registered increases of from 7½ to 10 per cent.

Oil Switches.—Heavy demand keeps stocks ragged, only certain sizes being available for immediate shipment. Factories are requiring up to ninety days on all orders for standard types for protection of induction motors. The current quotation on the 2,500-volt, 200-amp. switch is $64.

Wires.—Uncertain receipts tend to keep stocks badly broken. No price changes have been registered for some time, No. 8 bare copper being priced at $24 per 100 lb. in 200-lb. lots and No. 12 weatherproof at 34 cents per pound in 500-lb. lots.

Poles and Cross-Arms.—Delivery on these items remains uncertain on account of poor car supply at loading points, but goods are coming through fast enough to prevent any serious inconvenience. Prices show decided firmness, which is notable in view of the abrupt declines of the last few weeks in all other lumber products.

Locust Pins.—Stock conditions locally are much improved, although time is required for the delivery of orders of any great size. The limited supply of raw material seems to justify the present price, which in lots of over 2,000 is $52.94 per 1,000.

Porcelain Sockets, Receptacles, Etc.—Lists which were withdrawn on this class of material a few weeks ago have been reissued and show substantial increases all along the line. Supply is wholly inadequate to fill the current demand, although this demand is below normal.

Household Appliances.—The unusually heavy bookings of last spring are being filled as rapidly as possible, with cancellations and rejections apparently in no greater proportion than in previous seasons. Considerable talk has been heard about wholesale cancellations, but diligent search fails to find many definite cases.

BOSTON

Trade is running somewhat below the recent volume of sales, although many jobbers are booking business far in excess of previous summer weekly totals. In some cases long deliveries are slowing down orders, but except in motors and porcelain fittings, stocks are improving considerably. Collections are slow and unsatisfactory, some of the good customers of even the larger jobbers being a little tardy in settlements. High prices of labor and materials are holding back greatly needed house construction and acute congestion is expected this fall. Agitation for state and city financing of home building is becoming evident. Industrial building is still going forward with vigor. Prices are firm, with advances of 10 to 15 per cent in leading makes of motors quoted this week. Energetic efforts are being made by New England motor manufacturers to increase their facilities. Labor conditions exhibit no new complications, with the exception of an inter-union disagreement in telephone circles which has not yet threatened service continuity.

Motors.—Price advances of 15 per cent on General Electric two-phase, three-phase and direct-current motors and 10 per cent on Westinghouse, Century, Wagner and Robbins & Myers motors are announced. Deliveries vary beyond all ordinary quotations. The market is literally shot to pieces on motors of less than 10-hp. rating.

Wire.—Long deliveries are slowing down orders, according to some agencies. In moderate amounts, requirements are being well handled, however. Rubber-covered wire is quoted at $13.13 per 1,000 ft. for No. 14 in 5,000-ft. lots. Bare copper wire base is 23 cents and requires four to five weeks for delivery, and weatherproof sells at 27 cents base, averaging eight to ten weeks delivery in quantity. Some jobbers can ship from stock.

Rigid Conduit.—The arrival of deferred shipments is rapidly increasing jobbing stocks. A leading distributer reports a well-assorted supply on hand now of both large and small pipe, with more coming into town. Fittings are also in reasonable supply.

Controlling Apparatus.—Advances of 10 to 15 per cent are announced in motor-control equipment prices, corresponding to motor-price increases.

Flexible Armored Conductor.—This material is plentiful, and a steady price of $110 per 1,000 ft. in 5,000-ft. lots is quoted. The demand is good.

Non-Metallic Flexible Conduit.—Substantial stocks are reported, with fair demand, running to lower volumes of orders. Prices are firm, the ⅜-in. size bringing $33.50 per 1,000 ft. in 5,000-ft. lots, and ½-in. loom $36.50.

Electric Drills.—Stock shipments are being made on local orders. The price of a representative ¼-in. electric drill, 110 volts to 220 volts, is $100 net.

Fans.—Retail fan sales have been much stimulated by a week of continued extreme humidity. Wholesale stocks do not appear to be exhausted, however.

"Nail-it" Knobs.—Good supplies are on hand, and in barrel lots, these bring $34.65 per 1,000. Stocks are not excessive, however.

Sockets.—Current requirements are being met comfortably. In case lots pulls are quoted at 50 cents net each, keys at 28 cents and keyless at 26 cents.

ATLANTA

Jobbers report a shrinkage in the number of orders received, though on the whole the volume of business in electrical lines continues to hold up well. Sentiment indicates that a gradual contraction will be experienced as urgent calls for material on back orders are filled. Business in general shows signs of slowing up. Retailers are making every effort to liquidate their excess holdings and are somewhat adverse to placing new orders for heavy fall stocks. While this is largely traceable to the tightening up in the money market, the resistance of the buying public to high prices is having the effect of causing more cautious buying. Building construction continues to be delayed by the difficulty in transportation, and this, together with the rumor that some of the larger industrial plants—the textile trade in particular—will curtail operations in the next few days, has caused the labor market to ease up considerably. Residential and commercial building construction in the smaller towns has shown unusual signs of activity, and construction under way, while slow on account of material shortage, will be sustained in these centers for some little time to come.

Meters.—There are no 5-amp. or 10-amp. two-wire or three-wire meters in the territory, while the demand is strong. The larger sizes can be had in very limited numbers only, and shipments on large polyphase instruments are quite unsatisfactory. High tension types are quoted at from eight to fourteen weeks.

Outlet Boxes.—The scarcity in this item continues, the stocks of semi obsolete boxes being exhausted. Jobbers state that they can make no definite promises of delivery as yet.

Switch Boxes.—There are practically no supplies of this article in the territory, with little prospects of the situation improving in the near future. Such small shipments as come in are quickly absorbed by back orders.

Cut-Outs.—The shortage of cut-outs is acute, owing apparently to the difficulty in obtaining porcelain. No shipments of moment have been received in this territory for some time.

Distributing Transformers.—One jobber reports the receipt of eighty-four transformers, while his back orders amount to approximately 850. This is causing considerable delay in the connecting up of industrial plants recently changed to electric drive. Shipments on stock sizes are from sixteen to twenty-five weeks.

Schedule Material.—Stocks are reported in better shape than they have been for several months past, ample supplies of rosettes, sockets, tubes, knobs and cleats being reported. Prices—Snap switches, lots of 50 to 250, 5-amp., 34 cents each; key sockets, lots of 100 to 500, 38 cents each; rosettes concealed, lots of 50 to 250, 20 cents each; "Nail-it" knobs, $4.99 per 100.

Motors.—Jobbers are far behind in their motor orders, high fuel cost having caused even greater demand than was realized in the early spring. The 15 per cent price advance of last week, which came as somewhat of a surprise, has failed to check the demand. Deliveries range from twenty to fifty weeks, shipments on single-phase motors being particularly long.

Poles.—Car shortage continues to interfere with pole deliveries from local distributing centers, though jobbers are quoting immediate shipments out of Chicago to this territory. Freight charges are slowing down shipments from the latter point, however.

SAN FRANCISCO

The height of the fruit season coupled with the freight-rate advance has sent every wheel rolling on California railroads and has jammed every terminal and yard. The value of California crops will be close to a record-breaking figure this year, for, with the exception of the Sierra foothills and where a shortage of water exists in various localities, the total is enormous. This is a very important thing in a state where practically all cities and towns in the interior are dependent for their prosperity on natural products.

Bells.—A marked increase in lawlessness has produced a campaign for the installation of daylight alarm systems in banks, etc., and considerable missionary work is being done with firms along these lines. This apparatus is not stocked on the coast, but is shipped from the East on sixty days' delivery. Other bells are being sold, particularly special voltage bells or ones that are wound to operate on bell-ringing transformers.

Telephones.—The situation here is very serious and has resulted in practically depleting coast stocks and greatly lengthening deliveries. No improvement is in sight.

Wireless Equipment.—The present demand is rapidly increasing and exceeds even the call before the days of war-time regulations. Formerly certain dealers in each district were known as wireless headquarters, but now it seems more and more as though such material is being regularly stocked by all dealers.

Medical Appliances.—Expectations of a wet winter and the usual winter demand for vibrators and the like have caused the placing of good stock orders. Violet-ray machines have received particular emphasis from the visits of factory agents and from a regular increase in demand.

Farm-Lighting Plants.—The State Fair in Sacramento in September has alloted a considerable space for the exhibition and demonstration of this line. It will be divided into two sections, one covering lighting and the other household devices.

Household Appliances.—Early in the year the great difficulty was to procure factory deliveries, but now shipments are rolling in and surplus stocks have actually accumulated. Business has dropped off considerably and dealers are looking for solicitors to comb the field more intensively.

SEATTLE—PORTLAND

Conditions along electrical lines in Seattle and the Puget Sound district, generally speaking, show little if any improvement over the last few weeks. Jobbers still report sales of consequence at a minimum, while retailers state that sales of appliances and fixtures are lighter each week. However, both jobbers and retailers confidently expect sales to pick up considerably, starting early in September, after the vacation season is over. The building slump in Seattle, especially, is occasioning considerable comment because authorities aver there is no lack of money with which to finance legitimate building undertakings, and further because Seattle is so badly underbuilt in practically all classes of buildings.

Lumber buyers seeking to dodge the freight-rate increases have purchased heavily during the past week. Orders accepted by West Coast lumbermen exceeded production by 5 per cent and shipments by 13 per cent. Cars for lumber loading continue scarce, only about thirty per cent of actual requirements being furnished. There is no evidence of the reported rush of cars to the West to move lumber which was announced recently.

Vacuum Cleaners.—With but one or two exceptions these are the best selling household device on the market, and recent shipments are enabling dealers to meet the demand, which is expected to show continued increases. The recent price advance has not affected sales to any noticeable extent, though many are being made on the installment plan.

Water Heaters.—Demand is picking up, especially in the 4-kw. and 5-kw. sizes. Jobbers have good stocks and are prepared to meet the demand, which should show further increases this fall.

Schedule Material.—Stocks continue to accumulate, with the volume of sales sluggish on account of the continued slump in building.

Sewing Machines.—Slackening of demand is generally noted throughout the Northwest, though the past week showed a slight improvement in Seattle. Stocks are in good condition and prices are tending upward, although no decided increase has gone into effect recently.

Ranges.—Prices are apparently slowing up sales materially, as householders figure the expenditure is too great in face of uncertain conditions. Stocks are good.

Dry Cells.—Stocks are in good shape, but demand is below expectations. Shipments are coming through in a comparatively satisfactory way, and prices show no recent change.

SALT LAKE CITY—DENVER

Demand for all kinds of electrical equipment affecting the mining industry continues good, while other phases of the market are sluggish and uncertain. Nearly one-sixth of all electrical equipment and supplies sold in the Intermountain region is purchased by owners and operators of mines. Hoists, wires, lamps and tramway supplies are used in great quantities the year round. The summer is coming to a close with a general market condition that is slow and disappointing. Distributers and dealers are devoting much of their time and energy to preparing for the fall trade, which promises a satisfactory improvement over the average for the three months just past.

Despite the present discouragement there is persistent optimism about the immediate future. The electrical industry is banking on good crops to alleviate the condition of business lethargy. Crop yields on irrigated lands will be well above the average for the past two or three years, though yields in many dry farm sections are falling below official estimates. All in all, the prospects are good. The only concern of the farmers is the outlook for a satisfactory market and adequate transportation to move the crops. Growers of perishable products are especially purturbed over uncertainties of transportation. Already improvement is noted in the market for electrical supplies. The peak of the period of conditions approaching business stagnation seems to be safely passed. Inquiries and orders from dealers indicate a rapid revival of business throughout the Intermountain West. Collections are still slow and money continues tight.

Electrical Washers.—Manufacturers seem to have more than caught up with back orders and are urging jobbers to stock. Lines that a while back were the most scarce are now available in any quantities. Prevailing high prices discourage extensive buying.

Fans.—The season is rapidly on the wane. Stocks are pretty well cleaned up. Dealers are pleased with the volume of the trade for the summer.

Rotary Sewing Machines.—For some unaccountable reason this business has not had a satisfactory growth in the Intermountain region. Jobbers are awake to the possibilities, however, and are planning intensive campaigns calculated to stimulate trade.

Wire.—The condition of scarcity is greatly improved. Eastern factories that have been closed down on account of labor troubles are now making deliveries. The production of wire in the West is a growing industry. Factories operating near mining centers will be able more and more to meet the Western demand.

Lamps.—Trade is beginning to pick up. Slightly longer summer evenings are accountable for the increase. It is believed that the outlook will grow steadily better with the approach of fall and winter.

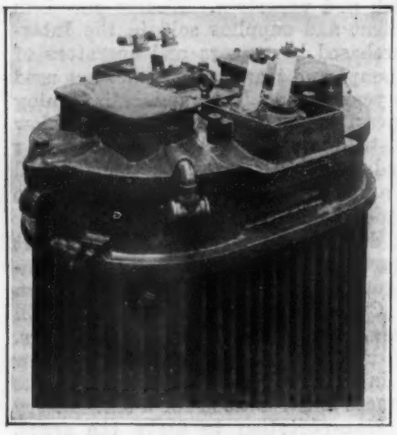
Heating Appliances.—Demand throughout the summer has been fair. Dealers are stocking now for winter and holiday trade.

New Apparatus & Appliances

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Transformer Bushing

A new type of bushing for use with outdoor-type transformers of moderate voltage has been put out by the General Electric Company, Schenectady, N. Y. The lower portion of the bushing is similar to the company's standard high-voltage bushing; ample clearance is provided in the housing. The use of these transformers is only limited, as

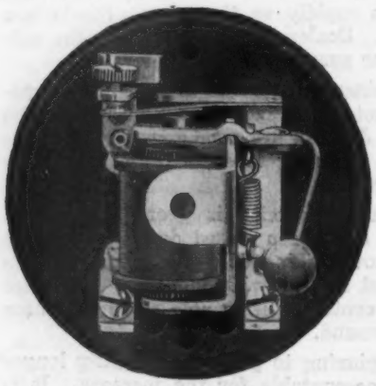


TRANSFORMER HOUSES MAY BE ELIMINATED

regards voltage, the maker says, by the voltage limits of the underground cable used in connection with them.

Dome Bell and Buzzer

The Holtzer-Cabot Electric Company, Roxbury, Boston, Mass., has developed a hub-dome bell and a hub-dome buzzer. The entire mechanism, which is mounted on a heavy molded insulation base, is

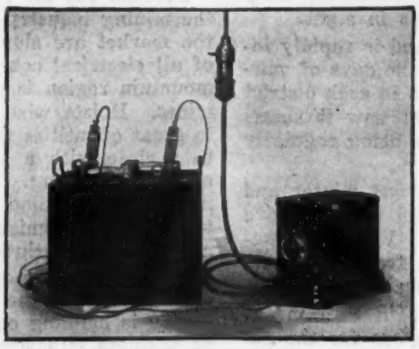


OPERATES ON EITHER ALTERNATING OR DIRECT CURRENT

underneath the gong. Greatest over-all width is 2⅞ in. It is claimed that vibration will not loosen the specially made self-locking contact screw. Either alternating or direct current may be used. The buzzer mechanism is similar to that of the bell.

Storage Battery Charger

A mechanical-type instrument for transforming 60-cycle alternating current from the lamp socket into direct

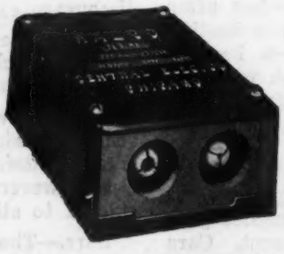


BATTERY NEED NOT BE REMOVED FROM CAR

current for storage-battery charging is being marketed by the King Electric Manufacturing Company, Inc., 20 North Niagara Street, Tonowanda, N. Y. The manufacturer says the apparatus is self-adjusting as regards time of charge and polarity, and that upkeep is extremely low.

Heavy Receptacle for Electric Welding

To meet the demand for a dependable receptacle and plug to be used in electric welding work, the Central

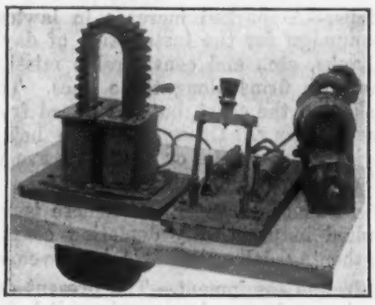


TWO PORCELAIN BLOCKS MOUNTED IN CAST-IRON CASE

Electric Company, 316 South Wells Street, Chicago, has developed the Ralco receptacles and plugs. The receptacle for use on two-wire direct-current circuits consists of two heavy porcelain blocks, in which are mounted heavy contacts forming a rectangular block which is approximately 5 in. x 4⅜ in. x 2¼ in. deep and is mounted in a substantial cast-iron case. It has a capacity of 225 amp. at 250 volts.

Set for Charging Permanent Magnets

The Esterline Company, Indianapolis, Ind., has placed on the market a new equipment for charging permanent magnets. This is designed to insure maximum charging of the magnets and to get them into place without losing a large portion of the initial charge. After the magnet has been charged, it

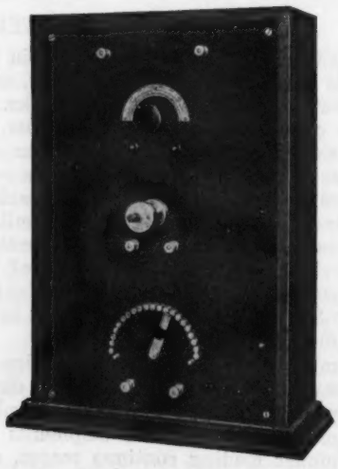


FLEXIBLE KEEPER HELPS TO RETAIN MAGNETISM

is lifted through the charging coils, the U-shaped keeper coming up with it, and a flexible keeper is then laid over the exterior of the magnet, remaining there until the magnet has been placed on the magneto frame. The coils are wound on bronze spools and can be furnished for any commercial direct-current voltage.

Radio Receiving Set

The junior receiving set, type HJR, manufactured by the Modern Radio Equipment Company, Elizabeth, N. J., is designed to meet the demand for a simple and efficient receiving set for beginners. It is portable, and only three adjustments are said to be needed.



RECEIVING SET FOR BEGINNERS

A dust-proof detector and variable condenser are mounted on the panel.

Note on Recent Appliances

Worm-Driven Hand Drill

The Arnold Electric Tool Company, New Haven, Conn., has developed a worm-driven portable hand drill, each section of which is a separate unit.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has taken a five-year lease of the Springfield (Mass.) "Homestead" building, where it will establish a mail-order house for the distribution of small electrical equipment and supplies. The building is close by the local post office and extensive alterations are being made to adapt it to the new service. It is planned to occupy the establishment about Sept. 1.

THE LEWIS ELECTRIC COMPANY, Massillon, Ohio, will soon start work on the construction of a new plant, 40 ft. x 120 ft., on Grant Street, for the manufacture of the Lewis safety entrance switch. The company is capitalized at $100,000.

THE FRANKLIN MOORE COMPANY, Winsted, Conn., manufacturer of electric hoists, small electric cranes, etc., has appointed William C. Briggs vice-president in charge of manufacturing. Mr. Briggs was formerly sales engineer and New York manager for the Shepard Electric Crane & Hoist Company, Montour Falls, N. Y.

THE YORK MANUFACTURING COMPANY, York, Pa., manufacturer of refrigerating machinery, ice-making machines, etc., has taken over the plant of the York Brewing Company, which it will utilize for experimental and testing departments, etc.

THE F. E. NEWBERRY ELECTRIC COMPANY, recently organized, has taken over the plant and holdings of the Newberry-Bendheim Electric Company, Los Angeles, Cal.

A. E. ROBERTS, formerly vice-president and general manager of the Hedden Iron Construction Company, Newark, N. J., has been elected first vice-president of the Milliken Brothers Manufacturing Company, Woolworth Building, New York City, manufacturer of radio towers, transmission towers, fabricated all-steel buildings for electrical service, etc. He will be in charge of the New York office and direct all matters pertaining to sales.

THE GOODMAN MANUFACTURING COMPANY, Forty-eighth Place and Halstead Street, Chicago, Ill., manufacturer of electric mine locomotives and kindred equipment, has leased a four-story building at 216 Penn Avenue, Pittsburgh, Pa., containing about 18,000 sq.ft. of floor space, for the establishment of a branch repair and supply works.

CHARLES EISLER, incandescent-lamp equipment engineer, has entered the consulting engineering field and is now designing and developing special and automatic machines for the manufacture of standard, miniature and gas-filled lamps. The organization will also maintain a department for manufacturing wire product used in the incandescent lamps for which machinery is being developed and installed. A temporary office will be opened at 159 Clifton Avenue, Newark, N. J.

THE BLACK & DECKER MANUFACTURING COMPANY, Baltimore, Md., announces that it has sent a letter to all jobbers handling its line, stating that there will be no reduction in prices this year, and that, starting Jan. 1, 1921, the company will protect its jobbers against loss through price reductions for sixty days after the purchase of goods. The letter says, however, that if conditions make a reduction possible, it will be made promptly so as to give the ultimate purchaser the benefit, and the company will absorb any loss which would otherwise be caused the jobber who bought within sixty days before the change in price.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, 17 Park Row, New York City is offering for sale 37,000 shares of capital stock (without par value), the proceeds to be used to provide additional working capital, extension of existing facilities, general corporate needs and the retirement of all preferred stocks now outstanding.

THE ROCHESTER ELECTRIC PRODUCTS CORPORATION, Rochester, N. Y., recently organized, has taken over the manufacture of the Rochester electric motor, formerly made by the Rochester (N. Y.) Motor Corporation. The Rochester Motor Corporation will concentrate on its Duesenberg type automobile engine. At present the Rochester Electric Products Corporation will manufacture direct-current apparatus only of the power-motor type from ¼ hp. to 15 hp., both constant and adjustable speed, horizontal and vertical drives, with plain bearings and ball bearings. D. W. Smith, with offices in the Singer Building, will represent the company in New York City and immediate surrounding territory, and Smith & Lewis, Real Estate Trust Building will cover the Philadelphia district. E. F. Davison is president, J. H. Kimmel is vice president and E. D. Smith, Jr., secretary.

HENRY HYMAN & COMPANY, INC., 476 Broadway, New York City, specialists in metal goods, announce that they have opened a branch office at 25 North Franklin Street, Chicago, in charge of Ernest Alschuler and Irving J. Jacobsen, who represent the United States Electric Manufacturing Corporation. They will take care of all business in the Western territory.

THE RAUSCH & LANG COMPANY has been granted a permit to build a 300-ft. x 320-ft., one-story, concrete-and-steel factory in the Willimansett section of Chicopee, Mass., for the manufacture of electric motor cars. The plant will cost about $275,000.

THE NATIONAL CARBON COMPANY, Cleveland, Ohio, has recently issued its No. 35 carbon-brush catalog, which supersedes catalog No. 34. Some grades of carbon brushes previously listed have been eliminated and others added. The number of types of shunts used has been reduced.

THE ALTORFER BROTHERS COMPANY, Peoria, Ill., manufacturer of electric washing machinery, has recently opened a branch office in the Bush Terminal Building, New York City, and also has established warehouse facilities in New York. This office will have charge of the sales in the territory east of the Ohio-Pennsylvania line and north of the Virginia-North Carolina line. The company states that the A B C ironing machine will be ready for the market in a short time. Walter L. Williams is manager of the New York office.

THE BRIGGS & STRATTON COMPANY, 110 Wisconsin Street, Milwaukee, Wis., recently organized, has started operations at its plant for the manufacture of the Briggs-Stratton Mellowes electric refrigerator. The officers are: S. F. Briggs, president; W. F. Manegold, treasurer; A. W. Mellowes, general manager, and B. M. Stoddard, sales manager.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces that new prices to the trade applying to list of spare parts for Emerson oscillating, non-oscillating and ceiling fans and to lists of spare parts for "Northwind" fans will be found in discount sheet No. 8100, dated Aug. 5, 1920, and effective that date. Discounts on power-motor spare parts formerly appearing in motor price book have been withdrawn and new discounts are being quoted on motor parts.

Supply Jobbers' Notes

THE RIGBY ELECTRIC SUPPLY COMPANY, Rigby, Idaho, and the Rexburg (Idaho) Electric Supply Company have consolidated and have opened a new place of business in Idaho Falls, Idaho, under the name of the Farm & City Electric Company.

THE BROOKLYN ELECTRICAL SUPPLY COMPANY, 56 Myrtle Avenue, Brooklyn, N. Y., has taken on several new lines within the past year and put two additional men on the road. The company celebrated its twentieth anniversary in June.

THE NEW ENGLAND ELECTRICAL SUPPLY JOBBERS' CLUB was the guest of Edwin C. Lewis, of the Lewis Electric Supply Company, Boston, at an outing held on July 13 at "Cedarholm," the residence of Mr. Lewis at Ponkapog, Mass. Twenty-one jobbing houses were represented.

Foreign Trade Notes

MARKET FOR ELECTRICAL FITTINGS IN ITALY.—While the demand for electrical fittings in Italy continues large, conditions have changed of late, as various local companies have been organized for the manufacture of these goods as well as electrical heating and cooking apparatus. There is, however, a great scarcity of all kinds of good electric light fittings which will take a long time to supply.

THE UNDER-FEED STOKER COMPANY OF CANADA, LTD., has been organized to take over the plant and property of the Jones Underfeed Stoker Company, Ltd. The new company is not only

OUTING OF NEW ENGLAND ELECTRICAL SUPPLY JOBBERS' CLUB

new in name and personnel but also in engineering and manufacturing advantages. To the experience of the former Jones Underfeed Stoker Company are added the engineering resources of the Underfeed Stoker Company of America. The officers are: Lloyd Harris, president; S. A. Armstrong, vice-president and managing director; James L. Ross, secretary.

THE ENGLISH ELECTRIC COMPANY OF AUSTRALIA, LTD., which is the alliance and extension of the Standard Waygood Hercules, Ltd., Sydney, and G. Weymouth Proprietary, Ltd., Melbourne, both of which were engaged in the manufacture and sale of electrical and allied machinery, has recently started operations. The new company is capitalized at about $3,000,000 and will develop the manufacture in Australia of electric machinery, etc. New works near Sydney are now being built and equipped.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in England (No. 33,481) desires to secure the representation of firms for the sale in South Africa of farm-lighting plants, etc.

A merchant in Italy (No. 33,482) desires to secure an agency for the sale of electric supplies, etc.

A member of a firm in Uruguay (No. 33,485) is in the United States and desires to purchase electrical equipment, farm-lighting machinery, etc.

Fabricantes Asociados de Maquinaria, Lonja del Comercio 540, Apartado 1766, Havana, Cuba, would like to communicate with electrical manufacturers or jobbers with a view to purchasing all the enameled and galvanized conduit it can obtain up to ten cars. The company would also like to get in touch with some of the larger electrical supply jobbing houses in the United States. H. W. Brooks is manager.

Trade Publications

CONDUITS.—The Garland Manufacturing Company, West Pittsburgh, Pa., is circulating two small leaflets, one entitled "Galvaduct" (galvanized) "Loricated" (enameled), covering its rigid conduits, and the other entitled "Sterling Flexible," describing its flexible armored conductor.

VALVE-CLOSING DEVICE.—The Cutler-Hammer Manufacturing Company, Milwaukee and New York, has issued an illustrated leaflet entitled "Extension to L Street Station, Boston," in which a brief description is given of the Dean control.

HEATING AND VENTILATING FANS.—The Buffalo Forge Company, Buffalo, N. Y., has issued catalog No. 421 on "Conoidal" fans for heating and ventilating purposes.

WATT-HOUR METERS — "Instructions for Sangamo D-5 Watt-hour Meters" is the title of Bulletin No. 54 published by the Sangamo Electric Company, Springfield, Ill.

RADIO APPARATUS. — The General Radio Company, Cambridge, Mass., has issued bulletins Nos. 101, 201, 202, 301, 401, 501, 701 and 901, describing its different types of radio laboratory apparatus.

AIR COMPRESSORS AND PUMPS.—The Crowell Manufacturing Company, 298 Taaffe Place, Brooklyn N. Y., is circulating two leaflets covering its type "A" and type "B" positive pressure blowers or rotary air pumps and type "D" rotary air compressors or vacuum pumps.

WOOD-STAVE PIPE. — Catalog No. 42 entitled "Wyckoff Wood Pipe," published by the A. Wyckoff & Son Company, Elmira, N. Y., describes its machine-made wood-stave pipe for waterworks systems, power plants, etc., and also Wyckoff's cypress steam pipe casing for underground and exposed steam and hot-water pipe.

WATERWHEELS AND GOVERNORS.—The Holyoke Machine Company, Worcester, Mass., has issued catalog No. 13, covering its different types of Hercules turbine waterwheels, and also a small booklet entitled "The Improved Governor," in which it describes its new governor for waterwheels.

VOLTMETERS AND INDICATING METERS.—The Roller-Smith Company, 233 Broadway, New York City, has recently issued bulletin No. 150, covering its small portable type H A voltmeters, ammeters and indicating wattmeters for alternating current.

SPUR GEARS.—"Gears from 'Standard of Baltimore' turn the Wheels of Industry" is the title of a booklet issued by the Standard Electric & Elevator Company, Inc., Baltimore, Md., describing the gears developed by the company in connection with general power transmission and special motor-driven apparatus.

New Incorporations

THE CALUMET MOTOR COMPANY, Houghton, Mich., has been incorporated with a capital stock of $100,000 to manufacture fractional-horsepower motors. The officers are Ocha Potter of Houghton, president, and John G. Bannetts of Calumet, secretary and treasurer.

THE ISLAND CITY ELECTRIC COMPANY, Long Island City, N. Y., has been incorporated by P. J. Shelley, W. A. Treadwell and W. S. Brown, Bridgewater, N. Y. The company is capitalized at $30,000 and proposes to manufacture electric lamps and other electrical products.

THE STEATITE ELECTRIC PRODUCTS CORPORATION, New York, N. Y., has been chartered with an active capital stock of $215,000 to manufacture electric heating equipment and appliances. The incorporators are T. D. Finizio, S. T. Moore and J. N. Strang, Yorktown Heights, N. Y.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MANCHESTER, N. H.—The Board of Education will soon award contract for the erection of a practical arts high school to cost about $450,000. Electric lighting will be installed. C. R. Whitcher, 814 Elm Street, is architect.

MANCHESTER, N. H. — Contract will soon be awarded by the Board of Education for the erection of a high school on Notre Dame Avenue to cost about $300,000. Electric lighting equipment will be installed. W. E. Provost, 581 Union Street, is architect.

ATHOL, MASS.—Bids will be reecived about Sept. 10 by F. A. Ball, chairman of a committee, for the erection of a memorial community hall to cost about $250,000. An electric lighting system will be installed. Brainerd, Leeds & Kellogg, 89 Franklin Street, Boston, are architects.

ATTLEBORO, MASS.—New bids will be received by the First National Bank until Aug. 24 for the erection of a four-story office building and bank. Electric lighting equipment will be installed.

GREENFIELD, MASS.—The town officials will soon receive bids for the erection of a high school to cost about $400,000. Electric lighting equipment will be installed. Address Harry Richardson, 23 Pleasant Street.

LANCASTER, MASS.—At a recent meeting the extension of the street-lighting system on Shirley Road was discussed.

LITCHFIELD, CONN.—Plans are being prepared for rewiring the city for electric light and power at a cost of about $40,000. F. O. Holm is city clerk.

Middle Atlantic States

LOUISVILLE, N. Y.—Petition has been made to the State Public Service Company by the Louisville Power Corporation for permission to construct a local electric plant.

NEW YORK, N. Y.—The New York Edison Company, Irving Place and Fifteenth Street, has plans under way for the erection of a transformer station on Seventy-fifth Street to cost about $500,000. William Whitehill, 12 Elm Street, is architect.

UTICA, N. Y.—The Utica Gas & Electric Company was not included in the Adirondack Power Company merger as was erroneously reported in these columns on July 17.

YONKERS, N. Y.—Contract has been awarded to Fitzpatrick & McArthur of Yonkers by the Yonkers Electric Light & Power Company for the erection of a transformer station to cost about $150,000.

HACKENSACK, N. J.—Contract has been awarded to the W. H. White Construction Company by the building committee of the Hackensack General Hospital for the erection of a hospital addition and power house to cost about $150,000.

ALLENTOWN, PA.—Specifications will be prepared by William R. Schnabel, civil engineer of the Water Department, for furnishing one 12,000,000-gal. centrifugal pump and one three-stage, 7,000,000-gal. pump, one 500-hp. electric motor improvements, etc.

PHILADELPHIA, PA.—Bids have been received by the Ferguson Carpet Company, Stenton and Rockland Streets, for the erection of a power house, 40 ft. x 76 ft. Stewart A. Jellet, Real Estate Trust Building, is engineer.

BALTIMORE, MD.—The Columbia Graphaphone Company, 16 South Howard Street, contemplates the installation of a 7,000 kw. generator for the operation of 568 motors from 2 hp. to 150 hp. each at its plant now being erected at Orangeville.

FREDERICK, MD.—The installation of one 125-kw. generator to be belted to existing unit at the municipal electric light plant is contemplated.

FREDERICKSBURG, VA.—The power house at the government proving grounds in King George County has been destroyed by fire, causing considerable loss.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, U. S. Army, Washington, D. C., until Aug. 26, for furnishing, under PR 4246-27CP, five 1-kw., 115-volt telephone motor-generators.

North Central States

BATH, MICH.—The Bath Electric Light & Power Company, recently organized with a capital stock of $5,000, contemplates the erection of a power house.

DETROIT, MICH.—Contract will soon be awarded by the American Machine Products Company, Eighteenth and Howard Streets, for the erection of a factory to cost about $45,000. Electric light equipment and wiring for power motors will be installed.

DETROIT, MICH.—The Public Lighting Commission, 40-56 Atwater Street, has awarded contract to the Contracting & Material Company, 3219 South Michigan Avenue, Chicago, Ill., for furnishing material and labor for installing electric light equipment on certain streets at $325,446.75.

DETROIT, MICH.—The Knights of Columbus, Detroit Council No. 305, 930 Woodward Avenue, is considering preparation of plans for the erection of a club house to include electric light equipment at a cost of about $500,000.

SUNFIELD, MICH.—Tentative plans will be prepared preparatory to an issue in bonds for a municipal electric light plant and for equipment for lighting in village.

CLEVELAND, OHIO. — The Masonic Temple Association, care of Albert Wright of the Otis Elevator Company, 1373 East Sixth Street, contemplates the erection of a memorial building to cost about $4,000,000. Electric wiring and elevators will be installed.

CLEVELAND, OHIO.—Bids have been received by city officials for furnishing one 10,000-kw. steam turbo-generator, condensers, auxiliaries and switchboard from the Merchants' Light & Heat Company, 2 West Washington Street, Indianapolis, Ind., $284,350; Westinghouse Electric & Manufacturing Company, Union Bank Building, Pittsburgh, Pa., $285,350; Allis-Chalmers, Park Building, Pittsburgh, Pa., $300,000.

DUBLIN, IND.—The erection of an electric light plant to cost about $9,700 is contemplated. Plans include the installation of a transformer, tower and switching equipment to cost $1,600.

EVANSVILLE, IND. — The Southern Telephone Company is considering placing all its wires in the fire district underground at a cost of about $15,000.

FORT WAYNE, IND. — The Board of County Commissioners has plans under way for the erection of a county farm building and power house to cost about $600,000. Charles R. Weatherhogg, Hamilton Bank Building, is architect.

INDIANAPOLIS, IND.—Work will soon be started on the construction of a power and boiler house for the American Hominy Company to cost about $45,000. The installation of generators, boilers and other considerable equipment, to cost about $45,000, will be made.

PETERSBURG, IND.—Bids will be received by the Board of County Commission until Aug. 30 for the construction of a court house to cost about $400,000. Electric wiring will be installed. Elmer E. Dunlap, 909 State Life Building, Indianapolis, is architect.

WEST HAMMOND, IND.—Contract has been awarded to the Broline-Nolan Company, 8 South Dearborn Street, Chicago, Ill., by the La Salle Iron Works, 2305 South Halstead Street, Chicago, for the erection of a steel plant to cost about $650,000 including equipment. Electrically driven machinery will be installed.

CHICAGO, ILL.—The Chicago Junction Railway, 38 South Dearborn Street, has plans under way for an addition to its power house and compressor plant to cost about $80,000.

NEW ATHENS, ILL.—The Probst Products Company of New Athens has been granted a twenty-year franchise permitting the erection of a pole line to Lenzburg for furnishing electric power there.

APPLETON, WIS. — Preliminary plans are under way by the Wisconsin Telephone Company, 418 Broadway, Milwaukee, for the erection of an exchange addition to cost about $50,000. Switchboards, etc., will be installed. A. C. Eschweiler, Goldsmith Building, Milwaukee, is architect.

BARRON, WIS. — Contract has been awarded by the city officials to Otto Berg, proprietor of the Taylor Flour Mill, for the installation of power-plant machinery to supply power and light in Barron.

MAYVILLE, WIS.—Petition of the Mayville Business Men's Association, care of secretary, for an ornamental street-lighting system in Mayville has been signed, and the matter will be taken under consideration by the City Council.

PESHTIGO, WIS.—Plans are under way for an addition, 26 ft. x 29 ft., to the power house of the Oconto Service Company, T. A. Pamperin, president. Mead & Seastone of Madison are engineers.

PLYMOUTH, WIS.—The Service Motor Company contemplates the erection of a public garage to cost about $100,000. Electric wiring and power equipment will be installed.

PORT WASHINGTON, WIS.—General contract has been awarded by the city officials to the Nordberg Manufacturing Company, Chicago and Oklahoma Streets, Milwaukee, Wis., for furnishing, erecting and connecting one condenser. J. Cooney is city clerk.

SHEYBOGAN, WIS.—The St. Nicholas Hospital, care of P. Reiss, 1225 North Seventh Street, has awarded general contract for the erection of a power house at the institution to cost about $50,000. Frank Geib, 1439 South Ninth Street, is engineer.

SPOONER, WIS. — Contract has been awarded to the St. Paul Electric Company, 145 East Fifth Street, St. Paul, Minn., by the Apple River Milling Company for the erection of a 30-mile, 22,000-volt transmission line, including transformers, at about $30,000.

WEST ALLIS, WIS. — A new lighting system for Greenfield Avenue is under consideration.

CANNON FALLS, MINN.—The Cannon Falls Milling Company, E. O. Holmstead manager, 822 Flour Exchange Building, Minneapolis, Minn., contemplates the erection of a dam about 150 ft. wide, at Cannon Falls, to furnish power for its own use.

GENOLA, MINN. — Contract has been awarded to Bergquist & Dunphy for the erection of a high-tension transmission line from Genola to Pierz. J. A. Hagen is city clerk.

HIBBING, MINN.—Petitions have been circulated for the installation of an electric lighting system on First Avenue, South. J. P. Murphy is city clerk.

ST. CLOUD, MINN.—The city officials contemplate the installation of electric lights on part of Germain Street. A. W. Buckman is city clerk.

MASON CITY, IOWA.—The Masonic Cathedral Association contemplates the erection of a temple to cost about $250,000. Electric wiring will be installed.

VINTON, IOWA.—An issue of $45,000 in bonds has been approved by the voters for additions to the municipal light and power plant and waterworks, including the installation of an engine and generator.

FARGO, N. D.—The Union Light, Heat & Power Company, M. L. Hibbard general manager contemplates having repairs made to its electric and gas plant at Fargo.

GRAND FORKS, N. D.—Bids will be received by the North Dakota Industrial Commission until Aug. 30 for installing piping and all auxiliary equipment, some of which has not yet been purchased, in the power plant at the new terminal elevator. C. L. Pillsbury, 805 Metropolitan Building, Minnneapolis, Minn., is engineer.

MINNEWAUKEN, N. D.—Bids will be received until Sept. 8 for the installation of an electric light plant. G. A. Gilbertson is city auditor.

NEW ROCKFORD, N. D.—The General Utilities Corporation has rejected all bids for furnishing and installing generators and engine at its power plant. The project has been abandoned.

OSNABROCK, N. D.—Contract has been awarded to the Electric Construction Company, Grand Rapids, Wis., for the installation of an electric light and power plant.

VALLEY CITY, N. D.—Contract has been awarded to McManis & Tarnoski, 484 Endicott Building, St. Paul, Minn., for the construction of a power plant at $60,000.

WATERTOWN, S. D. — Contract has been awarded to the Electric Construction Company, 174 East Sixth Street, St. Paul, Minn., for a lighting system and "white way" in the business district at $54,800. Contract for residence district has not been awarded.

NEWMAN GROVE, NEB. — The Nebraska Gas & Electric Company plans to re-equip its plant and erect transmission lines.

BONNER SPRINGS, KAN.—The Bonner Portland Cement Company contemplates the installation of transformers at its plant. P. R. Ladd is chief electrician.

MONTEZUMA, KAN.—It has been suggested by the Mayor and the City Council to call an election for the purpose of voting bonds for an electric light plant.

SALINA, KAN.—Plans are being prepared by Study & Farrar, architects, Arcade Building, St. Louis, Mo., for the erection of an administration building and an addition to the existing power plant at the Wesleyan University to cost about $400,000.

Southern States

NEW SMYRNA, FLA.—At an election to be held on Sept. 7 a bond issue will be voted on for the purpose of installing an electric lighting plant.

MEMPHIS, TENN. — The Item Biscuit Company of Omaha, Neb., contemplates the erection of an electric power plant for factory service at its new plant at Memphis. The total cost is estimated at about $500,000.

OXFORD, MISS.—At an election to be held on Aug. 27 the proposal to issue bonds for improvements, repairs, etc., to the municipal light plant and waterworks will be submitted to the voters.

TULSA, OKLA.—Bids will be received by the Thompson Brothers & Hughes until Sept. 1 for the construction of an office building to cost about $750,000. Electric lighting equipment will be installed. Herbert L. Bass, 801 Hume-Mansur, Indianapolis, Ind., is architect.

FORT SAM HOUSTON, TEX.—Contract has been awarded to Graham & Collins of San Antonio for the outside electric distribution system included in the plans for the construction of thirty-seven corrugated-iron warehouses on which work has been started. The cost of the project is estimated at about $2,000,000. Lieut.-Col. Fidelio G. Chamberlain is officer in charge of construction.

Pacific and Mountain States

ASTORIA, ORE.—The navy department has authorized extensive improvements to the local radio station to cost about $30,000.

REEDSPORT, ORE. — An election has been held for the purpose of submitting to the voters an issue of bonds to the amount of $50,000 for the construction, operation and maintenance of an electric light and power plant. J. K. Cavers is city recorder.

LOS ANGELES, CAL.—Bids will be received by the Board of Education, William A. Sheldon secretary, until Aug. 25 for electric wiring the gymnasium building to be erected on the Franklin High School site.

SACRAMENTO, CAL.—Bids will be received at the office of M. J. Desmond, city clerk, until Sept. 30 for furnishing nine power transformers ranging from 25 kva. to 500 kva. with auxiliary equipments and appurtenances; ten or more centrifugal pumps, from 4,000 to 14,000 g.p.m.; ten or more squirrel-cage induction motors from 50 hp. to 900 hp. or more; also one 10-ton electric crane, conduits, switchboards, etc., for the pumping and filtration works.

BRIGHAM CITY, UTAH.—An election will be held on Aug. 31 for the purpose of submitting to the voters an issue of $200,000 in bonds for rebuilding the municipal electric light plant.

SALT LAKE CITY, UTAH.—Owners of land in the Bonneville Irrigation District have voted to bond their property in the sum of $600,000 for the construction of an irrigation pumping system, including a power house. Plans call for two 500-hp. and two 900-hp. motors to be installed in the pumping station. Electrical energy will be secured from the 44,000-volt line of the Utah Power & Light Company.

KIMBERLEY, IDAHO. — An irrigation district is being organized in the Kimberly, Hansen and Murtaugh sections of Twin Falls and Cassia County, to irrigate 45,000 acres of land in what is known as the Hansen-Butte project. It is proposed to erect a pumping station on the Snake River near Murtaugh and generate electricity to operate the pumps, and also to have electric power for the tract.

Canada

BRANDON, MAN.—The Canada Gas & Electric Corporation contemplates the extension of its distribution system in Brandon. George Patterson is manager.

MINNEDOSA, MAN.—A bylaw has been submitted for the construction of a power plant having a capacity of 150 kw.-hr., to cost about $21,600.

WINNIPEG, MAN. — The civic power plant at Point du Bois was damaged by fire to the extent of $25,000.

FREDERICTON, N. B.—The New Brunswick Hydro-Electric Commission contemplates early construction work on the development of three water powers.

ST. STEPHEN, N. B.—The Maun Axe & Tool Company contemplates the purchase of 220-volt, 60-cycle, three-phase, alternating current induction motors as follows: One 10-hp., 900 r.p.m.; seven 20-hp., 1,200 r.p.m.; one 15-hp., 1,200 r.p.m.; one 40-hp., 1,200 r.p.m.

GODERICH, ONT.—The National Shipbuilding Company, W. H. Hutchinson, manager, contemplates the installation of electrically operated machinery for the handling of flax.

LONDON, ONT.—The erection of a new city hall to cost about $1,250,000 is contemplated. Electric light and elevator equipment will be installed.

SASKATOON, SASK.—A bylaw has been passed permitting extensions to the electric light and power plant to cost about $15,800. Andrew Leslie is city clerk.

Miscellaneous

WAILUPE, T. H.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the erection of a radio building at Wailupe (specification 4259).

(Issued Aug. 3, 1920)

1,345,075. DEVICE FOR TESTING POLE WINDINGS; Jasper F. Cullin, Detroit, Mich. App. filed Dec. 29, 1919. Polarity tested by compasses.

1,346,138. FLASHLIGHT DEVICE; Paul C. Smalley, Newark, N. J. App. filed March 29, 1919. Lens insulates reflector from casing.

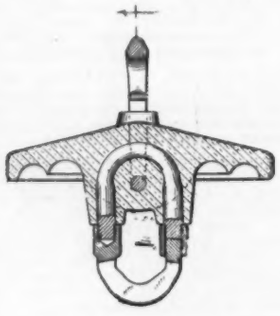
1,348,157. APPARATUS FOR AMPLIFYING PULSATING ELECTRIC CURRENTS; Lee de Forest, New York, N. Y. App. filed July 22, 1915. Oscillating audions arranged in tandem or in multiple.

1,348,171. SWITCHING-OVER DEVICE FOR ELECTRICAL LIGHTING INSTALLATIONS FOR RAILWAY TRAINS AND THE LIKE; Hugo Grob, Zürich, Switzerland. App. filed Nov. 9, 1915. Operation depends on strength of generator exciting current.

1,348,198. METHOD OF BUILDING INDUCTOR ELEMENTS FOR DYNAMO-ELECTRIC MACHINES; Vincent G. Apple, Dayton, Ohio. App. filed May 20, 1918. Electrically welded.

1,348,206. PLATE FOR ELECTROLYTIC CELLS; Lewis W. Chubb, Edgewood Park, Pa. App. filed April 4, 1917. Large area plates.

1,348,207. ELECTROLYTIC CELL; Lewis W. Chubb, Edgewood Park, Pa. App. filed April 4, 1917. Formed of striplike elements.



1,348,248. Disk Suspension Insulator

1,348,209. TELEPHONE-EXCHANGE SYSTEM; Edward E. Clement, Washington, D. C. App. filed July 15, 1907. Each trunk has a terminal selector switch for connecting subscriber's to idle trunk leading to first selector, and each switch returns to zero after clearing.

1,348,213. RADIO-TELEPHONE SYSTEM; Lee de Forest, New York, N. Y. App. filed Aug. 26, 1916. Using air jet.

1,348,236. SYSTEM FOR CHARGING STORAGE BATTERIES; Thomas L. Mount, New York, N. Y. App. filed June 19, 1918. Adaptable to railway car service.

1,348,239. ELECTRIC MOTOR; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed May 27, 1912. Totally inclosed.

1,348,248. DISK SUSPENSION INSULATOR; Louis Steinberger, Brooklyn, N. Y. App. filed Jan. 24, 1917. Uniform arc-over value in dry and wet weather.

1,348,259. INSULATING KNOB; Louis Steinberger, Brooklyn, N. Y. App. filed Jan. 17, 1918. For telegraph keys.

1,348,263. ELECTRICALLY HEATED SHOE-TREEING IRON; Edwin N. Chandler, Braintree, Mass. App. filed Nov. 23, 1913. Simple construction.

1,348,348. ELECTRIC REGULATION; John L. Creveling, Tucson, Ariz. App. filed March 14, 1916. Used with battery.

1,348,350. INCANDESCENT ELECTRIC LAMP; Theron Davis, New York, N. Y. App. filed Nov. 14, 1917. Filament on mandrel.

1,348,359. AUTOMATIC CIRCUIT-BREAKER SWITCHBOARD; John P. Hayes and John E. Barnhart, Pittsburgh, Pa. App. filed Feb. 4, 1919. Three-pole breaker for mounting back of board.

1,348,394. CIRCUIT-CONTINUING DEVICE; Harry A. Douglas, Bronson, Mich. App. filed Aug. 15, 1918. Bayonet socket.

1,348,395. CIRCUIT-CONTINUING DEVICE; Harry A. Douglas, Bronson, Mich. App. filed Aug. 15, 1918. Bayonet socket.

1,348,424. ELECTRICAL TEST SET; Eugene A. Johnson, Walla Walla, Wash. App. filed April 22, 1919. To cut meters in circuit.

Record of Electrical Patents

Notes on United States Patents

1,348,430. TELETYPEWRITER OR PRINTING TELEGRAPH; Einar G. C. Lofgren, Minneapolis, Minn. App. filed April 21, 1916. Adaptable to standard typewriters.

1,348,434. ADAPTER FOR ELECTRODE HOLDERS; Oliver J. Marshick, Detroit, Mich. App. filed Oct. 31, 1919. To increase contact area.

1,348,456. SPARK INDICATOR AND PLUG TESTER; John S. Stevenson, Baltimore, Md. App. filed April 29, 1918. Auxiliary spark gaps.

1,348,467. BATTERY PLATE; Arthur J. Adams, Milwaukee, Wis. App. filed Oct. 15, 1919. Grid arrangement.

1,348,469. CYLINDER FOR PAPER-DRYING MACHINES; John E. Alexander, Port Edwards, Wis. App. filed Nov. 26, 1917. For replacing steam-heated cylinders.

1,348,477. FAN; Allen A. Canton, New York, N. Y. App. filed Aug. 20, 1919. Fan and heater.

1,348,506. FOOT WARMER; Jose A. Mata, Berkeley, Cal. App. filed Nov. 25, 1919. Consists of guarded incandescent lamp.

1,348,530. ELECTRODE HOLDER; Thomas Willard, San Bruno, Cal. App. filed July 25, 1919. Insulated holder, clamps by rotary motion.

1,348,534. INSULATOR BRACKET; Charles H. Beine, Kenosha, Wis. App. filed June 29, 1918. Service wire clamp.

1,348,539. ELECTRIC MOTOR; Julius M. Breitenbach, New York, N. Y. App. filed March 23, 1917. Designed for differential of motor vehicles.

1,348,555. ENGINE STARTER AND GENERATOR; Thomas R. Du Bois, Niagara Falls, N. Y. App. filed March 4, 1915. Double-unit starter and generator.

1,348,620. PROTECTIVE SOCKET; Samuel L. Adelson, New York, N. Y. App. filed May 9, 1919. To prevent theft.

1,348,648. ELECTRIC HEATING ELEMENT AND WIRING THEREFOR; Sherman L. Kelly, Toledo, Ohio. App. filed Oct. 23, 1916. Reduces dissipation of heat from the under side.

1,348,717. TELEGRAPH INSTRUMENT; Jose V. Guerra, Santiago de Cuba, Cuba. App. filed March 31, 1920. Adjustable.

1,348,752. EXTENSIBLE ELECTRICAL FIXTURE; Roy E. Shaw, Spearfish, S. D. App. filed July 26, 1920. Reel device with spring for rewinding flexible extension cord.

1,348,780. TELEPHONE SYSTEM; Bryant D. Campbell, Oakland, Cal. App. filed April 3, 1917. Centrally controlled pay telephone system.

1,348,809. RHEOSTAT; John G. Kjellgren, Cleveland, Ohio. App. filed Jan. 6, 1917. Track-welding rheostat made of many fine wires in parallel.

1,348,825. METHOD AND APPARATUS FOR DETECTING LOW-FREQUENCY IMPULSES; Reginald A. Fessenden. App. filed May 21, 1917. For detecting submarines.

1,348,835. SWITCHING APPARATUS; Fritz Aldendorff, Wilmersdorf, Berlin, Germany. App. filed March 16, 1914. Automatic telephone switches.

(Issued Aug. 10, 1920)

1,348,907. ELECTRIC POWER SYSTEM; Ira T. Swartz, Indianapolis, Ind. App. filed June 23, 1917. Battery and generator set with relay devices for protecting battery against overcharge or undercharge.

1,348,909. TELEPHONE TOLL CIRCUITS; John F. Toomey, New York, N. Y. App. filed Feb. 20, 1919. Cords for preventing inefficient operation by toll operators.

1,348,948. ELECTRIC BUTT WELDING AND MOLDING DEVICE FOR METAL WHEEL RIMS; Joseph W. Jackson, Anderson, Ind. App. filed July 11, 1919. Mold prevents burr at point of weld.

1,348,949. ADJUSTABLE SUPPORT FOR ELECTRIC LAMPS; Johan P. Johansson, Fanalund, Sweden. App. filed April 19, 1919. Telescopic arm and weighted cord.

1,348,986. HIGH-TENSION ELECTRIC MACHINE; Charles Fayer, New York, N. Y. App. filed June 26, 1919. Improved insulation and accessibility of parts.

1,349,003. COMMUTATOR; Earle P. Lee, Rochester, N. Y. App. filed Aug. 20, 1918. Method of temporarily connecting leads to risers during winding.

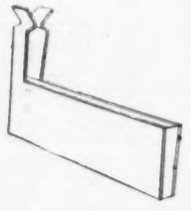
1,349,053. NON-METALLIC RESISTANCE ELEMENT AND PROCESS OF MAKING SAME; Alexander L. Feild, Lakewood, Ohio. App. filed June 16, 1919. Contains titanium carbide, zinconium oxide and boric anhydride.

1,349,100. DYNAMO-ELECTRIC MACHINE; William T. Reynolds and Bruce A. Reynolds, Port Arthur, Tex. App. filed May 4, 1918. Solenoids rotate shaft by means of crank.

1,349,103. RADIO-SIGNALING SYSTEM; James H. Rogers, Hyattsville, Md. App. filed May 2, 1917. Horizontal antennæ with grounded plates at ends.

1,349,104. RADIO-SIGNALING SYSTEM; James H. Rogers, Hyattsville, Md. App. filed Jan. 17, 1918. Horizontal antennæ.

1,349,140. HEATING APPARATUS; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 4, 1916. Japanning oven heated by electrically superheated steam.



1,349,003. Commutator

1,349,131. HEATING APPARATUS; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 4, 1916. For electrically superheating steam.

1,349,252. METHOD OF AND MEANS FOR UTILIZING THERMIONIC CURRENTS; Harold D. Arnold, East Orange, N. J. App. filed March 20, 1916. Straight line characteristic to prevent distortion.

1,349,278. MECHANISM FOR REGULATING THE POINT OF IGNITION IN MAGNETO-ELECTRIC IGNITION APPARATUS; Ernst Hurlimann, Zuchwil, near Solothurn, Switzerland. App. field March 23, 1918. Yoke and interrupter shiftable together or independently.

1,349,297. AUTOMATIC WATER FEED FOR STORAGE BATTERIES; Jack D. Sartakoff, New York, N. Y. App. filed July 1, 1919. Float valves in cells control entering water.

1,349,299. HIGH-TENSION DISTRIBUTER FOR MAGNETO-ELECTRIC IGNITION MACHINES; Jacques Schneider, Solothurn; Ernst Hurlimann, Zuchwil, and Frederic Billon, Solothurn, Switzerland. App. filed Aug. 22, 1919. Improvements in brush holders.

1,349,303. CURRENT REGULATOR FOR ELECTRIC WELDING MACHINE; Frederick S. Stearns, Swampscott, Mass. App. filed Nov. 4, 1916. Maintains constant temperature.

1,349,305. SIGNALING APPARATUS; William L. Walker, New York, N. Y. App. filed April 11, 1917. Submarine sound detection.

1,349,313. ELEVATOR SAFETY DEVICE; Andrew J. Barrett, Britannia Beach, B. C., Canada. App. filed Aug. 23, 1917. Prevents operation when door is open.

1,349,343. MAGNETIC CHUCK; John L. Moran, Worcester, Mass. App. filed Nov. 11, 1919. Improved arrangement of poles.

1,349,361. FURNACE REGULATOR SYSTEM; Edgar M. Bouton, Wilkinsburg, Pa. App. filed April 9, 1919. Changes taps on transformer.

1,349,363. CONTROL SYSTEM FOR ELECTRIC FURNACES; Ora A. Colby, Larimer, Pa. App. filed Feb. 15, 1919. Changes taps on transformer.